HOW TO TAKE PHOTOGRAPHS

BASIL COLLIER

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A Comprehensive Guide for Amateurs & Others

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INTRODUCTION

To THE newcomer photography is a paradise. He wanders through its sunlit meadows, happily pressing the button as the fancy takes him, rejoicing at his occasional successes and undismayed by his many failures. The former seem to him miraculous, as indeed they are; the latter cause him no distress because he does not expect much, and he that is down needs fear no fall. He neither knows nor cares how it is all done, he only knows that it is all delightful and reflects great credit on the clever people who thought it all up in the first place.

Nevertheless technical knowledge stands before him like the forbidden tree, and one unlucky day he tastes its fruit. Lured on by the serpent words of some photographer more experienced than himself, he begins to read books and ask questions. At once his paradise is shattered, his peace of mind destroyed, his comfort gone. Henceforth he makes his photographic way by the sweat of his brow and even his successes are poisoned by the reflection that they ought to have been more complete. In pain and difficulty he struggles on from day to day, distracted by divided counsels. One day he is lured on by cheerful but misguided men who assure him gaily that if he will only use camera A and developer B his path will be made smooth. On the next he is cast down by learned pedants who warn him of the awful consequences of leaving a print too long in the fixing-bath.

However, if we wish—as we all do sooner or later—to make progress in photography we must accept

books on the subject as a necessary evil. It is with diffidence that I add one to their number. Nevertheless I take comfort when I think how often I myself have wished for one which would bridge the gap between popular handbooks concerned only with the elements of the subject or a single aspect of it, and academic textbooks with their forbidding air of pedantry and their lack of evidence that the author has ever ventured outside the laboratory to take a photograph. What I wanted was not a monograph or a treatise, but a comprehensive guide by an impartial man who had himself made all the mistakes which those who rely on written instructions and casual advice are likely to make.

I do not know how far I possess the first of these qualifications, but am quite sure I possess the second. Few photographers can have made more mistakes or been more often led astray by hints and warnings which were always well meant but often horribly misleading. I do not flatter myself that I have left off making them, but believe I have got far enough to distinguish between what is sound and orthodox in photographic teaching and what is unsound and ephemeral. Perhaps this, too, is an illusion, but time alone will show.

Obviously the best way to learn photography is to take a course of practical study under the direct guidance of an expert. The beginner who can afford the time should apprentice himself, if he can, to a professional photographer whose work he admires and be prepared to pay for the privilege of setting up his tripod and washing his dishes. But for those of us who practise photography as a hobby or a part-time occupation this method is impracticable. We must

rely on books or the advice of friends and so incur the perils of the self-taught. It is unfortunate that, although there are many good books on photography, there are few which attempt to lay down sound principles of general application. Perhaps inevitably those few tend to be concerned mainly with theory and so contain very little information about *taking photographs*, although they deal exhaustively with aspects such as sensitometry which have little value for the practising photographer. On the other hand, popular handbooks are often the fruit of practical experience and do contain practical advice. But they tend either to be too elementary or to approach the subject purely from the viewpoint of the user of some particular kind of camera. Exponents of miniature photography, and authors who take it for granted that all serious photographers use cameras of half-plate size or larger, scarcely seem to be speaking the same language. With the best of intentions the former are apt to foster the false assumption that even small plate cameras taking quarter-plate negatives are cumbrous and outmoded objects fit only for museums. Yet the broad principles of photography have not changed in half a century and are surely the same whatever camera one uses.

The title of this book may seem to make a sweeping claim, but the intention behind it is quite modest. A photograph is taken when the shutter is opened to make the exposure; anything the photographer does in the darkroom can only help him to make or mar the conception he then had in mind. The choice of subject and viewpoint are the most important steps in the making of a photograph; after that comes the holding of the camera steady at the moment of exposure. The photographer should therefore aim at

making his procedure in the darkroom as simple and straightforward as he can and concentrate on studying his subject-matter. Improvement will come with increased awareness of the world about him, whose complexity he must interpret on the flat surface of a sheet of paper. Because exposure, development and printing are outwardly rather complex subjects it has been necessary to devote a large part of the book to them, but this proportion does not represent their true importance. The great thing is the making of the photograph, and to all intents and purposes the photograph is made in the camera and in the mind of the photographer. Before he presses the button he must know exactly what he intends the result to be, and anything he does afterwards is of value only insofar as it leads to that result.

The chapters that follow are addressed to beginners and also to photographers who have ceased to be beginners but are not yet experts. They deal only with essentials or what the author believes to be essentials. With trifling exceptions nothing is recommended either explicitly or by implication which the author has not tried. To cite references in such a modest book as this would be inappropriate, but in case anything said here seems controversial the reader may be reassured to learn that the suggestions made are based not only on a fairly lengthy experience which has involved many setbacks, but also on a careful comparison of modern authorities with those of sixty years ago. These men lived through the great formative period of photography. There is a tendency nowadays to regard photography as having begun about 1930, when it threw off the shackles of the pictorial movement and Edwardian bad taste. As a

corrective to this one-sided view it is worth remembering that, if our photographic fathers strayed from the path of orthodoxy, the same reproach cannot be levelled at our grandfathers, who understood the subject very well and who succeeded, by trial and error, in evolving principles which have stood the test of time.

B. C.

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CHAPTER I

EQUIPMENT AND MATERIALS

I

THE CAMERA

PHOTOGRAPHERS are sometimes accused of thinking too much about cameras and films. Painters, they are told, spend little time discussing paints and brushes. Nevertheless the subject is important. Unsuitable equipment is not only inconvenient, it may stifle the creative impulse and act as a complete bar to progress.

But when this has been said we must remember that a camera is only a tool, and a straightforward tool at that. It contains few moving parts and performs no complex function. Essentially it is a light-tight box: at one end is a lens which throws an image of the scene before it on to a piece of light-sensitive material at the other. Obviously there must be some means of replacing used material by fresh, and so the end opposite the lens (the back) is in the form of a detachable plate-holder or incorporates an arrangement of spools and keys for winding on a continuous length of film. Secondly, unless the camera is a very simple one we expect to be able to focus on objects at various distances and provision is made for doing so by varying the distance between lens and film. Thirdly, we want to know what picture we are getting; and this need is met either by allowing us to put a sheet of ground glass in the place later to be occupied by the film or plate, or by adding a view-finder, usually

placed on top of the camera. A slight weakness of the latter method is that obviously the view-finder cannot occupy exactly the same position as the lens and therefore does not give exactly the same picture. The difference is usually negligible except at distances smaller than about 12 feet, when some compensation must be made. Fourthly, a shutter is needed to keep light from the film or plate except at the moment of exposure. Incorporated in the lens and often forming part of the shutter is a diaphragm or 'stop', whose function will be explained below.

Here, then, is our basic camera—light-tight body, lens and shutter with diaphragm, focussing mechanism, removable plate-back or winding mechanism for roll-film, view-finder or ground-glass screen. But this basic design has a shortcoming which many photographers are willing to overlook but to which we ought not to remain blind. If we hold the camera level and point it at a fairly large object such as a building we often find that there is too much foreground in the picture and that the upper part of the building is left out. We can put this right by tilting the camera upwards, but then the back ceases to be upright and consequently the sides of the building are represented as converging towards the top of the picture, so that the subject appears to be toppling backwards. At an early stage in the evolution of the camera designers saw this weakness and overcame it by means of the device called a 'rising front'. The rising front enables the panel which carries the lens to be moved upwards without disturbing the back of the camera and so gives us the opportunity of photographing buildings and other tall objects without leaving out their upper parts or including too much foreground.

The rising front is a device of such obvious utility that one might expect no modern camera to be without it. But from the point of view of the designer of a hand camera it has one great disadvantage. Such cameras nearly always depend on view-finders to show what is included in the picture; and it is very difficult to design a view-finder which will show what happens when the rising-front is used. For this reason rising fronts are usually found only on cameras with ground-glass focussing-screens and intended primarily for use with plates or sheet films. Roll-film cameras and those which use motion-picture film to take still pictures (the Leica, for example) do not, as a rule, have rising fronts and, excellent as they are for many purposes, are therefore not very suitable for photographing buildings or other subjects with marked vertical lines.

We can therefore begin our survey of cameras by dividing them into two classes. On the one hand we have plate-cameras fitted with rising fronts and other adjustments needed for photographing buildings, architectural interiors, machinery and other subjects with marked vertical lines. These can be used with sheet films as well as with plates, and can sometimes be fitted with alternative roll-film backs which can be removed after each shot. On the other hand we have the roll-film and Leica-type cameras preferred by most amateurs, without rising fronts or similar adjustments. Let us consider briefly the advantages and disadvantages of the two classes.

For the professional photographer and the amateur who aims at a professional standard the plate camera has much to recommend it. Apart from the usefulness of the rising front and similar adjustments, much is

gained by the ability to remove the film or plate immediately after exposure and develop it at once. On the other hand, the plate-holders have to be loaded in the dark, and the photographer who has exhausted his immediate supply is at a loss until he can get back to his darkroom. (There is a device called a changing-bag which overcomes this handicap, but then there is one more thing to carry. There are also film-packs which enable the user of a plate-camera to carry the material for a large number of shots, but they are rather dear and only a few plate cameras will take them.) Perhaps a bigger disadvantage is that if full advantage is taken of the facilities provided by the plate camera a good deal of time is occupied in setting the outfit up and composing and focussing the image before the picture is taken. A hand-or-stand plate camera overcomes this weakness by providing a view-finder and focussing-scale like those of a roll-film camera. When the photographer is in a hurry he can dispense with the niceties of the rising front and focussing-screen, using the camera as rapidly as he would a roll-film camera but retaining the ability to develop his negatives one by one. When he has more time and when the subject is static he can take advantage of the facilities which only the plate camera provides. Even the most compact of plate-cameras is, however, rather bulkier than a roll-film camera designed to take a picture of the same dimensions.

The advantages of the roll-film or ciné-film camera are that it is compact and portable, and generally fairly light. It can be loaded in daylight with enough material to take six, eight, twelve, sixteen, thirty-six or even a larger number of shots. It is designed for

swift action and can often be used when a larger camera would be an embarrassment. Its chief disadvantage, as we have seen, is that its lack of a rising front and similar adjustments make it generally unsuitable for architectural photography; but this weakness can sometimes be overcome by choosing a high viewpoint. The fact that all the negatives on the roll must be exposed before the first can be developed may or may not be a handicap; and some miniature cameras provide a means of cutting off short lengths and developing them separately.

In the light of the foregoing we can classify the various kinds of camera available as follows:

A. PLATE CAMERAS

1. Field Cameras (also called View Cameras)

Field cameras (as well as the larger but roughly similar studio and technical cameras used by commercial photographers) provide a wide range of adjustments and are intended for the most exacting work. Besides a rising front they often have a back which can be swung to the vertical position when the camera is tilted. As a rule the front swings too. The camera must be used on a substantial tripod. The image is composed and focussed by examining it on a ground-glass screen which occupies the position later to be occupied by the film or plate. When all is ready the shutter is closed, a plate-holder is substituted for the ground glass, and after a light-tight slide has been withdrawn the shutter is opened again to take the picture. This performance conduces to accuracy, but is rather laborious and makes the photographer a

conspicuous target for any small boys in the neighbourhood. Nevertheless these pains must be endured if really good architectural photographs are wanted; they can be mitigated by early rising.

The most useful sizes for a field camera are half-plate ($6\frac{1}{2} \times 4\frac{3}{4}$ inches), whole-plate ($8\frac{1}{2} \times 6\frac{1}{2}$ inches) and 10 × 8 inches. Plates and films in the larger sizes are expensive. Excellent field cameras by such famous makers as Adams, Gandolfi, Kodak, Thornton-Pickard and Watson can be bought second-hand at prices which are very reasonable in view of their good workmanship. From three to six double plate-holders should be bought with the camera and their condition should be checked, for they must be light-tight. The lens and shutter are less important as they can easily be changed.

2. Hand-or-stand Cameras

When a tripod is available and the subject not in rapid motion a hand-or-stand camera is used exactly like a field camera. For action shots or when the tripod cannot be used it becomes a hand camera. Focussing is then done by measuring or guessing the distance between subject and camera and setting a pointer opposite the appropriate mark on a scale. A view-finder is used to compose the picture.

Thirty or forty years ago hand-or-stand cameras taking 5 × 4-inch, 9 × 12-centimetre or quarter-plate ($4\frac{1}{4} \times 3\frac{1}{4}$-inch) negatives were the favourite equipment of the keen amateur photographer. They are now less popular; consequently second-hand specimens can be bought at remarkably low prices. Among many good models are the Houghton Sanderson, the Sinclair Una and the Zeiss Ideal. The buyer should

make sure that his purchase includes enough plate-holders in good condition or that defective slides can be replaced. The single metal plate-holders supplied with Continental hand-or-stand cameras should be carefully scrutinised, as they are apt to buckle with hard use and admit light. Models which take 6 × 9-centimetre plates are useful, both because the small size keeps down running costs and because they can often be fitted with alternative roll-film backs. With modern materials and methods there is no difficulty in enlarging the resulting pictures to full exhibition size. On the other hand, a larger size makes the composition of the image easier when the ground-glass screen is used and increases the suitability of the apparatus for the more exacting branches of architectural photography.

The most ambitious cameras in this class are those like the Speed Graphic, the Linhof Technika and the M.P.P., whose designers seek to combine in varying proportions the qualities of a good field or technical camera with those of a sturdy hand camera for press photography. As a rule they have or can be fitted with optical range-finders coupled to the focussing mechanism in such a way that the range-finder not only measures the distance from camera to subject but simultaneously sets the lens in the right position for that distance. Often they are fitted with 'focal-plane' shutters which go just in front of the plate or film and are capable of giving the very short exposures needed to photograph subjects in rapid motion without the aid of flash-bulbs. When the focal-plane shutter is used the normal shutter incorporated in the lens must be left open. Naturally these cameras are considerably more expensive than the simpler kinds without range-

finders or focal-plane shutters and they often have a wider range of adjustments in order to fit them for use as architectural and technical cameras.

3. *Large Reflex Cameras*

An obvious shortcoming of the hand-or-stand camera is that it loses some of its accuracy when used without a stand. No view-finder can give such a reliable indication of the picture that will appear on the negative as does a focussing-screen; and focussing by scale and pointer nearly always involves some guesswork. A coupled range-finder solves the second difficulty but not the first. The reflex camera solves both, at the cost of some added complexity.

Like a field or hand-or-stand camera, a reflex camera has a focussing-screen, but instead of being at the back it is on top, so that the image which appears on it can be studied from above. A deep hood shields it from extraneous light and relieves the photographer from the necessity of burying his head in a black cloth. The image is the right way up, though laterally reversed. Extremely accurate focussing is possible and at all ranges the screen shows exactly what will be included in the picture. What is more, it can be watched right up to the moment of exposure. When a button is pressed the reflecting mirror which throws the image on to the screen moves up, sealing the top of the camera and allowing the image to pass through to the back. As soon as this has happened the shutter—which is necessarily of the focal-plane variety—moves aside to take the picture.

From the designer's point of view the chief difficulty of this arrangement is that the mirror and the mechanism which moves it must be exceptionally well

made, for otherwise the focussing would not be accurate and the camera might be shaken at the very moment when rock-like steadiness is vital. Consequently good reflex cameras are on the expensive side. A minor disadvantage is that the presence of the mirror makes them fairly bulky. The best of the larger reflex outfits—of which the Graflex and those made by the firm of Newman and Guardia are good examples—are among the most efficient hand cameras on the market. They usually have rising fronts, but cannot be fitted with such a wide range of adjustments as cameras of the orthodox field pattern, and are not quite so suitable for architectural photography.

B. ROLL-FILM AND CINÉ-FILM CAMERAS

4. Small Reflex Cameras

The problem of bulk has been well solved in the smaller reflex cameras, of which the Ihagee Exakta and the Zeiss Primarflex are excellent examples. Some of the cameras in this class take roll films, others use ciné film and give pictures of the same size as the well-known Leica. As a rule they do not have rising fronts, but in compensation provide a number of attractive features such as extremely rapid shutters and a wide choice of lenses interchangeable with the standard lens. The best of them are extremely efficient instruments, popular among professionals and amateurs alike, and ideal for photographing children, animals and street scenes. They are also suitable for portraiture. In common with other small cameras they do not lend themselves so readily to architectural or landscape photography, for which cameras taking fairly

large negatives are best. Nevertheless they have been used with success for such subjects by some well-known professional photographers. They are fairly expensive and are not cameras for the beginner, since the focal-plane shutters with which they are fitted are by no means fool-proof.

5. Twin-lens Cameras

As we have seen, a possible objection to the reflex camera is that the focal-plane shutter and the mechanism which moves the reflecting mirror are delicate pieces of machinery, which add considerably to the cost of the apparatus and may cause trouble if they are carelessly or roughly handled. These drawbacks are ingeniously overcome in the so-called twin-lens reflex (better called the twin-lens camera) of which the popular and highly efficient Rolleiflex is the classical example.

A twin-lens camera really consists of two cameras, one on top of the other. The upper camera contains a fixed mirror and has a ground-glass screen on top; the lower one is used to take the picture. The two lenses are coupled together so that focussing the top one causes the lower one to move into the right position to take the picture. As the mirror does not move, and a focal-plane shutter is not needed there is little to get out of order and the whole assembly can be made extremely rigid. The twin-lens camera therefore comes as near as it is possible to get to a fool-proof camera. The only drawback—and that a minor one—is that as the viewing lens and the taking lens are about 2 inches apart the picture on the screen is not exactly the same as that which appears on the negative. At ranges greater than about 12 feet the difference is

negligible; at shorter ranges some compensation must be made, and automatic or semi-automatic devices are often incorporated for the purpose. Their weakness is that, although they may indicate the true limits of the picture, they do not compensate for the slightly different viewpoint. In all other respects these cameras are highly precise instruments and capable of the most exacting work. For the beginner or for the more experienced photographer who can pay a good price and does not need a rising front or similar adjustments they are hard to beat.

6. Folding Roll-film Cameras

With the exception of the simpler hand-or-stand outfits all the cameras described so far have been of the expensive kind. With the popular folding roll-film camera we enter a wider field, which includes some very simple and inexpensive outfits as well as some which are just as dear as the best field, reflex and twin-lens cameras.

The essential feature of the folding roll-film camera is that there is no focussing screen. Focussing is usually done by rotating the lens or its front element until the appropriate figure comes to lie against a pointer. As a rule the distance from camera to subject must be guessed or measured with a tape measure or pocket range-finder; but the more expensive models have coupled range-finders like those fitted to the more elaborate press cameras and also to the Leica. Composition is done with the aid of a view-finder which is necessarily somewhat inaccurate at close ranges. The virtues of this design are compactness and simplicity. For the reason given on page 15, rising fronts and similar adjustments are not provided. The models

available range from the expensive and highly efficient Zeiss Super-Ikonta to popular models costing only a few pounds. In the intermediate classes there are many excellent cameras such as the Zeiss Nettar and the Ensign Selfix. The reader can take it that practically any folding roll-film camera, if fitted with an anastigmat lens by a well-known maker, will do all that the average amateur requires; the chief difference between the expensive makes and those of moderate cost is that the latter call for more pains on the part of the photographer if mistakes are to be avoided.

7. Miniature Cameras Taking 35-millimetre Film

Since the introduction of the Leica in 1925 miniature cameras which take negatives measuring 24 × 36 millimetres on standard motion-picture film have enjoyed an immense vogue. The ingenious design and consummate workmanship for which the best of them are notable, as well as the superb results of which they have proved capable in the hands of specialists, have caused many people to underrate the difficulty of securing consistently good results with such tiny negatives. It cannot be too strongly emphasised that, although the Leica, the Contax and a few other 35-millimetre cameras are almost incredibly precise and efficient instruments, and as such are beyond reproach, they are scarcely the right tools for the photographer who seeks the easiest path to photographic success. To make a 10 × 8-inch print from a 24 × 36-millimetre negative calls for an enlargement of some nine diameters, or in other words the print is about eighty times the area of the image in the camera. Enlargements of twenty diameters or more are not uncommon.

Magnifications of that order demand immense care as well as a good deal of luck if flaws are to be avoided and the results are to stand comparison with the products of larger cameras, whose negatives have only to be enlarged some three or four diameters to give pictures of the same size. Nevertheless in the eyes of many of us the neatness and adaptability of the 35-millimetre camera far outweigh this handicap, and to some the very difficulty of the tiny format is a stimulus.

The cameras in this class fall into three sub-classes. First there are the miniature cameras with coupled range-finders, such as the Leica, the Contax and the Ektra. These are expensive and highly efficient; they all have focal-plane shutters and can be fitted with a variety of interchangeable lenses, including some very fast lenses suitable for action photography in poor light. Secondly there are the miniature reflex cameras, which belong more properly to class four; of these the Kiné-Exakta is perhaps the best. Thirdly, there are simpler miniatures, without range-finders, such as the Berning Robot, the Agfa Karat and the Ilford Advocate. The last are considerably cheaper than the more elaborate models, but are capable of excellent work if used with care. In general, all three classes are most suitable for informal portraiture, action shots and street scenes; they are less suitable for architectural photography (except close-ups); still less for distant landscapes, which call for a bigger negative.

8. Box Cameras

Box cameras are generally very simple outfits with relatively cheap lenses. With some models no focussing is necessary: the lens is so adjusted that everything more than about ten feet from the camera is tolerably

sharp. This arrangement implies a very small aperture (see section 2 of this chapter) so that instantaneous exposures cannot be made except in a good light. Close-ups can be taken at fixed ranges by means of supplementary lenses. Other box cameras provide two or three alternative settings of the lens, again with a small aperture. Still others, with slightly better lenses, allow of normal focussing by scale and pointer.

In general box cameras are not suitable for advanced work but are quite satisfactory for snapshots which are not intended for great enlargement. They can be used for time-exposures if put on a tripod or other firm support such as a table. The best are those with brilliant finders almost as large as the negative; the finders fitted to some old models are so small as to be almost useless.

Among the best-known examples are the Ensign Ful-Vue, the Ilford Craftsman and various models of the Kodak Brownie.

By reading the foregoing paragraphs and studying the shop windows even the beginner should be able to form some idea of the camera that will suit his needs. No detailed description of the various types has been attempted, for examples are easily seen and dealers are usually quite willing to explain their points.

If the reader is interested in architecture, even to a small extent, he may conclude that only a camera with a rising front and other adjustments will meet the case. At the same time he may be unwilling to sacrifice the convenience of the roll-film or 35-millimetre camera. As old plate cameras are quite cheap a practical solution is to buy a second-hand field or hand-or-stand outfit as well as a Rolleiflex

or Leica. If this costs too much the second string can be a simple folding roll-film outfit like the Zeiss Nettar, or one of its British rivals. Such a combination, with a very few accessories, will enable the owner to tackle almost any subject, and the experience gained with the larger camera will help him to get the best out of the smaller one. Another solution, which avoids any doubt as to which camera should be taken on a particular occasion and which left at home, is a plate camera of moderate size designed to take film-packs or a roll-film back as well as plates and sheet films.

The great points to remember are that only the photographer himself can decide what camera will suit him and that price is not a reliable index of suitability. The public seems to enjoy paying for expensive gadgets designed to adapt small cameras for a variety of purposes for which orthodox opinion regards them as inherently unsuited. Consult a dealer, but remember that the opinions of even the most conscientious vendor are likely to be coloured by his economic interests as well as by his preconceptions. During the last ten years exceptional circumstances and the publicity given to certain cameras have raised their price inordinately, while others which may be as good or better for the reader's purpose have remained comparatively cheap.

THE LENS

A SINGLE lens such as a reading-glass has a limited value in photography because it gives a sharp image only over a narrow field. Except in the centre the image is blurred by inherent defects or aberrations.

The lens of a camera must cover a relatively wide field and the image must be reasonably sharp and well-lit even at the edges. In good photographic objectives the aberrations are therefore corrected by combining single lenses which may be either cemented together or separated by air-spaces. As a rule both methods are used in one objective.

Highly corrected objectives of the kind now common date from about 1890 and were made possible by the introduction of new kinds of glass. Before that date some good lenses had been made, but they all suffered from the defect known as astigmatism. Because they were the first to overcome the fault the new lenses were called anastigmats, although stigmats might have been a better word and has been used by some opticians. To the lens-maker 'anastigmat' has a more or less precise meaning, but in popular usage it has been retained as a generic term for well-corrected lenses.

With the exception of a few used for special purposes, practically all lenses fitted to modern cameras other than box cameras and the cheapest folding roll-film cameras are anastigmats. Although they differ very much in quality, for practical purposes the reader can assume that any anastigmat supplied with a modern camera which takes negatives measuring 6 × 9 centimetres or larger will be equal to the demands likely to be made on it by the average user. Below that size we are in the miniature class, and more exacting standards must be applied. The lenses fitted to the more rudimentary miniature cameras are often noticeably less good than those fitted to the more expensive models, and the difference is reflected in the price.

The majority of lenses popular today are more or less direct descendants of a few basic types designed, towards the end of the nineteenth century or early in the twentieth. The Zeiss Tessar and Protar, the Goerz Dagor, the Voigtländer Collinear and Heliar, the Taylor-Hobson Cooke Anastigmat and the Ross Homocentric were all introduced about half a century ago. Modern lenses which bear the same names are not necessarily made to the original designs, but retain many of the features of their parents.

Among the best and most popular lenses fitted nowadays to the larger and medium-sized cameras are the Zeiss Tessar, the Schneider Xenar, the Ross Xpres, the Wray Lustrar and various versions of the Cooke Anastigmat. The most popular lenses for miniature cameras include smaller models of the Tessar as well as the Zeiss Sonnar and Biotar and the Leitz Elmar, Summar and Summitar. There are many others, but to list more than a few in a work of the present scope would be impossible. The names of the leading lens-makers are household words throughout the photographic world. The reader who is not already familiar with them will soon become so if he studies the shop windows.

The size of a lens is given in two dimensions, namely, its focal length and its aperture. For practical purposes the focal length is the distance of the lens from the back of the camera when it is focussed on a remote object. To bring a nearer object into sharp focus the lens must be moved further from the back by means of the focussing mechanism. When its distance from the back is equal to twice the focal length, an object whose distance from the lens is also equal to twice the focal length will be sharply focussed and will be rendered

full-size on the negative. Thus to make full-scale negatives of small objects such as coins or insects a long extension is necessary. Field cameras and many hand-or-stand cameras cater directly for this need; other kinds can be used for close-ups by removing the lens and attaching it to an extension-piece which screws into the camera. If an extension equal to more than twice the focal length is available direct magnification on to the negative is possible without using a microscope. A simpler method of taking close-ups is to reduce the focal length of the lens by adding a supplementary lens to the front of it; but as the addition is bound to upset the corrections to some extent the definition is not likely to be so good.

A lens is considered to be standard for a given camera if its focal length is about equal to the diagonal of the negative. Thus, a 6 × 9-centimetre negative measures 10.5 centimetres from corner to corner, therefore a camera of that size is usually fitted with a 10.5-centimetre or 11-centimetre lens. If this condition is observed any well-corrected lens should cover the whole negative sharply, giving an angle or view of about 53 degrees. But often a lens of longer focus gives a better composition.

The other measurement which we need to know when discussing a lens, namely its aperture, is simply the diameter of the hole through which it admits light to the camera. It is usually stated, not directly in inches or centimetres, but as a fraction of the focal length. For example, if the focal length is 10.5 centimetres, or about 4 inches, and the effective diameter of the hole is 1 inch, or a quarter of that figure, the aperture is f/4. On the front of such a lens we shall find engraved something like 'F=10.5 cm. f/4', or

possibly '1 : 4 f=10.5 cm.'. Some old lenses, however, are engraved with the actual diameter, usually in millimetres. The 'relative aperture' or 'f number' can then be found by the simple process of dividing the figure into the focal length, expressed in the same units.

Obviously, the larger the hole through which light enters the camera the greater the quantity that reaches the film or plate. By increasing the aperture we therefore reduce the exposure needed to take the photograph. As short exposures have obvious advantages, especially when the camera is used without a tripod, we might expect that all lenses would be made with exceedingly large apertures. In practice the issue is not so simple. A very large aperture not only complicates the design of the lens and increases the price, it also gives the photographer a facility which he can seldom use. In order to understand this limitation it is necessary to grasp the thorny problem of depth of field.

In theory a lens can only be focussed for one distance at a time. If we focus it on an object 84 feet away, objects 83 and 85 feet away ought to be out of focus. In practice, if we take a photograph with our 4-inch f/4 lens focussed at that distance we shall find when we have made our print that everything more than 42 feet from the camera appears sharp, or in photographic language is included in the depth of field. Why this unexpected benefit? The answer is that although in theory objects nearer or further away than 84 feet are not sharp, in practice their lack of sharpness is so small down to 42 feet from the camera that the eye cannot detect it. Obviously the line between sharpness and unsharpness is not an easy one

to draw, but none the less opticians are able to draw it with some assurance. For practical purposes it can be assumed that at a distance of 10 inches or more the eye cannot distinguish between a point and a circle whose diameter does not exceed $\frac{1}{100}$ of an inch.

If we make the further assumption that photographic prints will always be viewed at distances equal to or greater than their diagonals, we can calculate the effective depth of field for any standard lens at any setting. The basis of these calculations (on which the table in appendix A is founded) can be summed up in the statement that if a point within the field of view is represented in the image by a circle whose diameter does not exceed one thousandth part of the focal length of the lens, it will appear as a point, not only on the negative and on a contact print, but on any enlargement from that negative, provided that the enlargement is seen from the proper viewing distance.

This statement does not hold good when lenses of more than the standard focal length for a given camera are used, or when enlargements are made from parts of negatives. In such circumstances—which apply to the majority of photographs taken with very small cameras—a more exacting standard must be applied. The table in appendix B should be used in all such cases.

If we repeat the experiment with an f/2 lens of the same focal length as the first we shall find that, instead of beginning at 42 feet and extending to the horizon, the field which appears sharp begins some 14 feet further away and extends to about 170 feet from the camera. At shorter ranges the field is much shallower. With the f/4 lens focussed at 12 feet it extends from 10 feet 6 inches to 14 feet, and with the f/2 lens

similarly focussed from about 11 feet to 13 feet. As most subjects have greater depth it is clear that even with very careful focussing a 4-inch f/2 lens could seldom be used at that aperture in practice.

Taking all this into account, the lens-maker makes his lenses with apertures as wide as he thinks reasonable and as the customer's pocket will stand, and adds a diaphragm with which the size of the hole can be reduced when greater depth of field is needed than can be got at full aperture. He also provides a calibrated scale which enables the photographer to 'stop down' by regular steps, so calculated that each reduction halves the brightness of the image and therefore doubles the exposure needed to produce the same effect on the film or plate. The scale usually employed in English-speaking countries reads:

f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/45, f/64.

On the Continent the following scale is more common:

f/2.2, f/3.2, f/4.5, f/6.3, f/9, f/12.5, f/18, f/25, f/36, f/50, f/72.

The reader who consults the tables in appendices A and B will notice that, even when allowance has been made for the different standards, the short-focus lenses fitted to miniature cameras give more depth of field than larger lenses. Hence they can be used at wider apertures, and so exposures can sometimes be made in the hand with a small camera when a larger camera would have to be used on a stand. But the practical difference is less than it appears, for with large

cameras exceedingly fast films and plates can be used without much risk of spoiling the picture by coarse grain. Again, fairly large cameras are easier to hold still than miniature cameras, so that longer exposures can be given in the hand. Judged by results and not by theoretical possibilities the best performances with respect to depth of field for hand-exposures are usually obtained with cameras of the middle size. The miniature scores, however, when a brief exposure and moderate depth of field are needed to photograph a subject in rapid motion.

The beginner who grasps the rather complicated problem of depth of field at the outset will gain a big advantage over others. He will understand that, although expediency may sometimes force him to use a particular stop because it makes a short exposure possible, in principle the stop should always be chosen to give the necessary depth of field. Only when that point has been settled should the effect on the exposure be considered. The first duty of a photograph is to be sharp. If any important part of it is not sharp the photographer had better have spared his pains and saved his film.

3

CHOOSING LENSES

As A rule the buyer of a folding roll-film or twin-lens outfit can choose his lens only by choosing his camera. If his means permit he should buy a model fitted with a lens by a famous maker, but heavy expenditure on an exceptionally wide aperture is another matter. Very few photographs are taken with stops larger than f/4, and to pay for a wider aperture

on the chance that it may be needed on rare occasions seems unreasonable. Nevertheless it may sometimes be necessary to do so in order to get a lens which meets one's requirements in other respects.

Field, hand-or-stand, reflex and Leica-type cameras often provide both a choice of standard lenses and a variety of others interchangeable with the standard lens. When such cameras are bought new, the buyer can order those he wants; when they are bought second-hand, unsuitable lenses can sometimes be exchanged for others at little extra cost.

Interchangeable lenses may be either carried on separate panels or fitted with adaptors so that they will screw into a common flange. Those made for miniature cameras are threaded to fit the same flange as the standard lens without further adaptation. Where a built-in range-finder is fitted they are usually 'coupled' to work with it.

The value of alternative lenses is not always apparent to the beginner, but should be clear to anyone who has tried to take a head-and-shoulder portrait with the standard lens of an ordinary roll-film camera. Thus equipped, one can seldom fill the negative without getting so close to the subject that the apparent size of an ear or a nose which projects towards the lens is enormously exaggerated in the picture. The perspective remains mathematically correct, but the unnaturally close viewpoint makes it seem too steep. A lens of greater focal length enables the photographer to fill the negative from a greater distance and so preserve a more natural perspective. He could get the same perspective with the standard lens by using it at the same distance from the subject, but in that case half the negative would be wasted and the fine

detail would not be so well rendered. Even so the method is often useful. In portraiture especially the beginner should be on his guard against the unnatural effect which comes of getting too close to the subject, no matter what lens he uses.

The value of long-focus lenses is not confined to portraiture. Inanimate objects which bulge or project towards the lens—such as bowls, jugs and other artefacts—call for the same treatment. Similarly, in landscape photography a long-focus lens often enables the photographer to choose a viewpoint from which the relative size of background and foreground appears more satisfactory than it would do if the standard lens were used.

Conversely, if the subject is large and can only be photographed at close quarters a lens of less than the standard focal length may be needed to get it all into the picture. Common examples are rooms and buildings in narrow streets. We are accustomed to see such subjects drawn and photographed at close quarters and so the inevitable steepness of the perspective does not worry us, especially as the objects depicted are too large to be taken in at a glance and thus no direct comparison with normal visual experience can be made. In other cases, where a more distant viewpoint would have been possible, a close viewpoint and a short-focus lens may be deliberately chosen in order to get an effect of monumental grandeur. Landscapes with immensely tall trees in the foreground and triumphal avenues receding into the distance sometimes respond well to this treatment.

In these cases an ordinary lens of less than the standard focal length is useless, for it would not cover the whole negative: the image would be dim and

fuzzy at the edges and the corners might be cut off entirely. A wide-angle lens of special construction must be used. Some normal lenses are, however, exceptional in this respect and will cover negatives whose diagonals are appreciably longer than their focal length. Examples are the Goerz Dagor, the Zeiss Protar, the Meyer Euryplan, the Voigtländer Collinear and the Turner-Reich Convertible Anastigmat. All these lenses are symmetrical, or in other words consist of identical or almost identical parts which are themselves well-corrected multiple objectives capable of serving separately as lenses of greater focal length than the combination. By buying a symmetrical lens whose focal length when assembled is a little less than the diagonal of the negative it is thus possible to get, in one and the same objective, both a standard lens of rather wider angle than usual and a long-focus lens or even a choice of long-focus lenses.

There are many other symmetrical lenses besides those mentioned, but not all are convertible. All, or nearly all, however, have better covering power than most unsymmetrical lenses of the same dimensions.

Many readers will find that their needs are amply met by a standard lens. Others, who propose to undertake a wide range of work, including architectural photography, and whose cameras permit the interchange of lenses, may feel the need for a full battery. The lenses should generally be bought in the following order:

(1) Either a standard lens (focal length = diagonal of negative) or a symmetrical lens of slightly less than the standard focal length.

(2) A long-focus lens of one-and-a-half times or twice the standard focal length. The separate

elements of some symmetrical lenses provide both.

(3) Either a wide-angle lens (focal length = slightly more than half the standard focal length) or a symmetrical lens with a focal length about equal to the shorter side of the negative.

(4) Intermediate sizes to meet special needs.

Long-focus lenses call for an extension which must exceed their focal length by at least an inch or so to provide a margin for focussing. Wide-angle lenses often cause some trouble. The extension they need is so short that the folded bellows may obstruct the image and the end of the baseboard fall within the field of view. A well-designed field camera overcomes these difficulties by providing bellows of the right pattern and a focussing mechanism whose working is unaffected by dropping the baseboard clear. An alternative arrangement used in some large cameras is to keep the lens-panel level with the front of the baseboard and focus by moving the back.

So long as these points are met a full battery of lenses can be used with almost any field or hand-or-stand camera. Reflex cameras will generally take long-focus lenses (suitably mounted in focussing-mounts which provide the necessary extension), but not lenses of very short focal length, because the presence of the mirror prohibits their being brought near enough to the focal plane. Miniature cameras like the Leica and the Contax generally take a range of specially mounted lens from moderately short to very long.

Where a lens of extreme focal length is needed and

the provision of the necessary extension is impracticable, a telephoto lens is sometimes useful. Essentially, a telephoto lens is a lens of normal construction joined to a supplementary lens which magnifies the image and so increases the effective focal length without requiring a corresponding increase in extension. Those sold for use with miniature cameras generally serve the same purpose as normal long-focus lenses and are used in exactly the same way. For long-distance photography with larger cameras variable-focus telephoto lenses can be bought. Their use falls a little outside the scope of general photography and for all ordinary purposes either normal long-focus lenses or fixed-focus telephoto lenses are to be preferred.

THE SHUTTER

ALMOST all shutters used with modern cameras smaller than half-plate size are either of the between-lens or focal-plane pattern. The former is an integral part of the lens, the latter of the camera. As the choice between them is usually dictated by the kind of camera preferred on other grounds, no useful purpose would be served by discussing their respective merits.

A range of speeds from 1 second to $\frac{1}{250}$ of a second is ample for most purposes, although some between-lens and most focal-plane shutters give higher speeds as well. It should not be assumed that the marked speeds are necessarily achieved in practice. The focal-plane shutter fitted to the Exakta (except model A and Exakta Junior) is unique in providing a series of

slow speeds up to 12 seconds and a delayed-action device which works at speeds between 6 seconds and $\frac{1}{1000}$ of a second.

Lenses for cameras which do not have focal-plane shutters should be bought ready fitted with between-lens shutters, preferably of the Compur, Compound or Epsilon type.

Some lenses for half-plate and larger cameras are too big to take between-lens shutters and recourse must be had to a less efficient type which goes in front of the lens or immediately behind it. In this case the highest speed obtainable is usually about $\frac{1}{80}$ of a second. If such a lens is wanted purely for indoor work at small stops, so that exposures are commonly of the order of several seconds or even minutes, a shutter is not necessary and exposures may be made by removing and replacing a light-tight cap. Whatever the method, care must always be taken not to jog the camera at the moment of exposure.

5

FILTERS AND HOODS

As PRACTICALLY all plates and films in general use are unduly sensitive to the blue end of the spectrum, blue skies tend to print too light. Whenever blue sky appears in the picture the tendency should be corrected by interposing a filter which partially obstructs the passage of the blue rays. The appropriate colour may be anything from light yellow to light red or even dark red, according to the nature of the film or plate and the amount of darkening thought desirable. The exposure must be multiplied by a factor which

may be anything from one and a half to twelve or more.

As a rule a light- or medium-yellow filter with a factor of one and a half or two is most suitable. Deeper filters are sometimes useful to emphasise the contrast between a light building and an intensely blue sky, and occasionally a yellow-green filter may be needed to darken the sky without darkening light-green foliage. A true green is seldom suitable for outdoor subjects.

When the sun is shining shadows are decidedly blue in relation to the sunlit portions of a scene. Any filter that darkens the sky is therefore bound to increase the inherent contrast of the picture to some extent. If the sun is not shining this natural colour-contrast is absent, although there may be a contrast due to the local colour of the subject. The widespread belief that so-called 'contrast filters' can be used to brighten up an inherently dull scene rests largely on a misconception. A filter may, however, be employed in such conditions, as well as when the sun is shining, to reduce the effects of haze and so render a distant scene more clearly.

Filters are also used in the photography of textiles and works of art to distinguish between colours which may be tonally similar although they appear quite different to the eye. For example, a red cross on a green ground might appear as a uniform grey tone if photographed without a filter. By means of a red filter it can be rendered as a light cross on a darker ground, or by means of a green filter as a dark cross on a lighter ground.

An interesting and at first rather puzzling application of filters is the use of a filter of roughly the same

colour as the subject when photographing such things as furniture and stonework, which have a pronounced grain or shallow surface texture. In these cases the filter accentuates the subtle colour-contrasts which make the effect apparent to the eye, so that what might seem an exception to the general rule governing the use of filters is really a confirmation of it. The rule is that wherever there is an inherent colour-contrast in the subject a filter can be found which will emphasise it. It is because such colour-contrasts are usually weak in outdoor subjects lit by diffuse light that attempts to brighten them up by using filters nearly always fail.

Manufacturers of films and plates supply gelatine filters for use with their products. These are valuable for technical and scientific purposes, but for general photography the glass filters sold by all photographic dealers are quite satisfactory and much easier to handle.

Another valuable accessory is a hood to shield the lens from bright lights and glaring reflections within its field of view but outside that part of it which is used to make the negative. A hood is seldom superfluous and may be indispensable when photographs are taken with strong side-lighting or against the light. The tubular metal hoods of circular section which are widely sold for the purpose are not above reproach, but will do quite well if their inner surfaces are kept well blacked. Adjustable hoods of bellows pattern are more efficient but bulkier, and in practice are seldom used.

6

OTHER ACCESSORIES

OTHER accessories which the reader is advised to get are:

(i) A tripod. It should be the stoutest and heaviest he is prepared to carry. A pan-and-tilt head is useful but not essential.

(ii) A cable-release for making the exposure without shaking the camera when it is on a tripod.

(iii) An exposure-meter or exposure tables (see Chapter III).

(iv) A camel-hair brush for dusting lenses, plate-holders and other parts.

(v) Two or three no. 1 photofloods for use indoors. They cost no more than ordinary electric-light bulbs, give about eight times as much light as the strongest domestic bulb and burn for about two hours. As they are seldom wanted for more than a few minutes at a time they will do for a great number of pictures. Two or three portable reflectors should be bought at the same time.

(vi) A spirit-level and a focussing-cloth (for plate cameras only). A focussing-magnifier is sometimes useful.

Equipment for developing and printing is dealt with under those headings.

7

FILMS AND PLATES

THE wide range of films and plates offered by manufacturers is a stumbling-block to many beginners; who see no reason for the existence of more than two or three varieties.

The subject is best understood by glancing first at the chief points of difference between the various products. They are: (1) colour-sensitivity; (2) speed; (3) grain; (4) gradation; (5) thickness of emulsion layer; (6) physical characteristics such as the type and thickness of the glass or celluloid support.

1. Colour-sensitivity

Most of the films and plates used in general photography are either panchromatic or orthochromatic. Panchromatic films and plates are sensitive to light of all colours; orthochromatic films and plates are sensitive to light of all colours except red. 'Ordinary' or 'regular' films and plates, which are sensitive only to blue and violet light, are not recommended. Panchromatic materials themselves differ considerably in their sensitivity to light of different colours. Some are unduly sensitive to the red end of the spectrum, while practically all are unduly sensitive to blue. The most balanced colour-rendering is given by panchromatic films and plates of moderate speed.

2. Speed

The speed of plates and films, or in other words their sensitivity to light of standard intensity and colour, varies enormously. Unfortunately no com-

pletely satisfactory method of expressing speed has yet been found. In ordinary photographic practice a film or plate is not exposed to light of uniform intensity and colour but to a whole range of illuminations corresponding to the different parts of the subject. The systems of measuring speed in common use today and generally found adequate are:

(i) The Weston system, introduced by the makers of Weston exposure-meters and based on tests which are said to approximate closely to normal working conditions. The speed is expressed in simple arithmetical terms, a film rated at Weston 24 being reckoned twice as fast as one rated at Weston 12, and so on. As with other systems, standard development is assumed. Widely used by photographers on both sides of the Atlantic.

(ii) The system of American Standards Association Exposure Indices, also based on practical tests for which a similar claim is made. For ordinary purposes A.S.A. Exposure Index 64 can be taken as equivalent to Weston 50, and so on.

(iii) The system of British Standard Exposure Indices. The method of testing is the same as that used in the A.S.A. system, but the results are rather unhappily expressed in 'degrees' instead of arithmetically. A.S.A. 50 = B.S. 28 degrees, A.S.A. 100 = B.S. 31 degrees, and so on.

The films and plates most widely used in general photography have speeds between Weston 12 and Weston 80 or 100. Generally, high speed means coarse grain and moderate speed fine grain. For miniature cameras it is advisable to use films rated

between Weston 12 and Weston 50 unless the utmost speed is essential.

3. Grain

A grainy effect in photographs which have been much enlarged is due to the clumping or apparent clumping together of the microscopically small silver grains in the negative during processing. The degree of clumping which takes place is governed largely by the choice of developer and time of development, but also depends on the inherent properties of the film or plate. Thirty-five-millimetre film is specially designed to give fine grain, but even so the faster varieties may not stand up to very great enlargement. Their tendency to give coarse grain can be offset by special development, but only at the expense of their effective speed.

4. Gradation

If a film or plate is correctly exposed and properly developed, the resulting negative will reverse the values of the subject in such a way that equal differences in brightness between different parts are represented by equal differences in density between the corresponding parts of the negative. This condition can be satisfied in more than one way, for it is not necessary that the differences themselves should be equal in the subject and the negative. Thus a difference of brightness of x units in the subject may be represented in the negative by a difference of x units, $2x$ units, $x/2$ units, or any other multiple of x units. In the first case the negative will be of normal gradation, in the second case of hard or steep gradation, and in the third case of soft or gentle gradation.

Which of these three types is desirable? At first sight it might seem that the photographer's object should always be a negative of normal gradation, which exactly reverses the values of the subject. In fact this is not so. Whereas subjects differ enormously in brightness-range, the density-range of the negative must be adjusted to suit the paper used to make the print. A subject of high brightness-range or contrast therefore calls for a negative of soft gradation, and vice versa. Consequently the photographer should, in theory, use a film of inherently steep gradation when photographing subjects of low contrast and one of soft gradation for subjects of high contrast. In practice the gradation of the negative can be controlled to a large extent by development, so that a film which is neither inherently very soft nor very hard will meet most cases.

Many films and plates intended to give soft gradation are on the fast side and cannot be developed to a high contrast without building up excessive grain. Relatively slow films of inherently steep gradation, on the other hand, can often be successfully developed to give normal to soft contrast, usually at the cost of reducing their effective speed still further.

5. *Thickness of Emulsion Layer*

The sensitive layer with which films and plates are coated consists mainly of silver salts and gelatine. By long-standing custom it is called the emulsion, although it is not really an emulsion but a jelly. Its thickness has an important bearing on the quality of the negative. If the layer is too thick the rays of light may be scattered as they pass through it and the resolving power of the emulsion will suffer accord-

ingly. Conversely, an extremely thin layer is commonly associated with low speed, steep gradation and low tolerance to errors in exposure.

6. Physical Characteristics of Support

The most obvious distinction under this head is between glass plates and films which carry the emulsion on a celluloid support. Sheet films employ a robust type of support which is treated so that it does not curl. Thus they can be handled almost as easily as plates. For roll films thinner material is used and careless handling may cause kinks. The material used for 35-millimetre film is of intermediate thickness and reasonably robust. Roll films have a paper backing which protects them from light when they are rolled up. Lengths of 35-millimetre film are without it and are protected by a light-tight cartridge or cassette.

Plates, sheet films and roll film are generally coated at the back with a layer of coloured material designed to minimise reflection of the image back through the emulsion and the consequent spreading of high values into adjacent areas—a fault known as halation. Once common, halation is now seldom seen except as the result of gross over-exposure or when unscreened lights are included in the picture. It is more likely to occur with plates than with films. Although plates can be bought unbacked, for all ordinary purposes the backed kind should be specified. With certain exceptions (noted in the chapter on development) the material dissolves harmlessly in the developer and has no effect on the process of development.

Thirty-five-millimetre film can also be given a coloured backing, but often a neutral dye incorporated

in the base is used instead. The dye may not be removed by development, but in any case has no adverse effect on the printing quality.

In the light of the foregoing a rough classification of the most popular films and plates can be attempted. With the exception of those designed for special purposes, nearly all of them fall into one or other of the following classes:

CLASS 1. *Relatively slow, thin-coated panchromatic films.*

Example: Ilford Pan F 35-mm. film.

Characteristics: Thin emulsion, moderate speed, balanced colour sensitivity, extremely fine grain, high resolving power, normal to steep gradation.

Applications: All occasions when high degrees of enlargement are required, with the possible exception of subjects of excessive contrast. Even subjects of high contrast can, however, be handled successfully with careful development.

Speed: Weston 12 to 16.

CLASS 2. *Slightly faster films and plates of similar characteristics to class 1.*

Examples: Kodak Panatomic X 35-mm. film, roll film and sheet films; Kodak P. 300 plates.

Characteristics: As for class 1, but with slightly greater latitude in exposure and development.

Applications: A good choice for all-round use.

Speed: Weston 20 to 24, reduced to Weston 12 to 16 by extra-fine-grain processing.

CLASS 3. *Panchromatic films and plates of slightly softer gradation than class 2.*

Examples: Ilford F.P.3 35-mm. film, roll film and sheet films; Ilford Soft Gradation plates.

Characteristics: As for class 2, but tend to give softer gradation.

Applications: Suitable for all-round use and especially for subjects of high contrast.

Speed: Often stated to be about the same as for class 2; but for the best results settings between Weston 32 and 50 are recommended. These speeds are reduced to about Weston 24 to 32 by extra-fine-grain processing.

CLASS 4. *Moderately fast panchromatic films of soft to normal gradation.*

Example: Kodak Plus X 35-mm. film.

Characteristics: Fairly fast, double-coated emulsion, reasonably fine grain, normal to soft gradation, allow of wide variations in exposure and development.

Applications: Suitable for all-round use when very high degrees of enlargement are not required. A good choice for the newcomer to miniature photography.

Speed: About Weston 50, reduced to Weston 32 by extra-fine-grain development.

CLASS 5. *Moderately fast orthochromatic films of soft to normal gradation.*

Examples: Ilford Selochrome and Kodak Verichrome roll films; Ilford Selochrome sheet films.

Characteristics: As for class 4, but insensitive to red light. Unlike panchromatic films, which must be handled in complete darkness or by the dim light of a panchromatic safelight, orthochromatic materials may be handled by the red light of a ruby safelight.

Applications: Suitable for all-round use when very high

degrees of enlargement are not required and when sensitivity to red light is not essential. As artificial light generally contains a high proportion of red and orange rays, orthochromatic films are relatively slower in electric light than panchromatic films.

Speeds About Weston 50, reduced to Weston 32 by extra-fine-grain development. Whereas panchromatic films are generally considered to retain about two-thirds of their normal (daylight) speed in electric (tungsten) light, that of orthochromatic films is reduced to less than half.

Orange and red filters should not be used with orthochromatic films and with deep-yellow filters higher factors than those applicable to panchromatic films are indicated. These points are usually covered in the leaflet supplied with the film.

CLASS 6. *Fast panchromatic films and plates, generally of rather soft gradation.*

Examples: Ilford H.P.3 and Kodak Super XX 35-mm. film, roll film, and sheet films; Ilford H.P.3 and Kodak P.1200 and P.1500 plates.

Characteristics: Fast and often specially sensitive to red light. In most cases do not give such fine grain or have such high resolving power as slower films. Tend to give rather soft gradation, but steeper gradation can usually be obtained by prolonged development at the expense of coarser grain.

Applications: Specially suitable for the photography of moving objects and in artificial light. Suitable for all-round use in the larger sizes, where relatively coarse grain does not matter. Not recommended for miniature photography except when speed is the

deciding factor or when a moderate degree of enlargement is sufficient. Finer grain can be obtained by curtailed development in special developers, but the effective speed is considerably reduced and the gradation tends to be rather soft.
Speed: About Weston 100, reduced to Weston 64 to 80 by extra-fine-grain development and to Weston 32 to 40 by development for still finer grain.

In the light of the foregoing notes the reader should have no difficulty in finding a plate or film to suit his needs. The examples have been chosen because they are generally available: no adverse criticism of plates or films not mentioned is implied. A personal opinion is that for advanced work with 6 × 9-centimetre and smaller negatives the films in classes 1 and 2 are most suitable, but that where high degrees of enlargement are not needed those in classes 4 and 5 have many advantages, especially for beginners. With larger cameras F.P.3 and Panatomic X sheet films and P.1200 and Ilford Soft Gradation plates are all excellent. Although the large number of good films, plates and developers available provides an almost irresistible temptation to experiment with different combinations, the best course is to choose not more than two types and stick to them, at any rate until their possibilities have been thoroughly explored.

CHAPTER II

CAMERA AND SUBJECT

1

HANDLING THE CAMERA

A MAN who is learning golf will practise at all hours and can barely be restrained from trying out his swing in drawing-rooms and bedrooms. Photographers seldom follow his example, yet they could learn much by making 'dummy runs' without a film in the camera.

Every owner of a camera should practise handling it until the correct drill is second nature. A suitable sequence of operations with a roll-film or miniature camera is as follows:

1. Wind on film.
2. Compose image roughly in view-finder.
3. Focus.
4. Work out depth of field, set stop accordingly, and if necessary adjust focus.
5. Work out exposure and set shutter accordingly (see Chapter III). Allow for filter if one is to be used.
6. Adjust filter and hood.
7. Cock shutter (unless it has already been cocked by winding on the film).
8. Check focussing and setting of stop and shutter.
9. Compose image accurately in view-finder.

10. Hold breath.
11. Release shutter.

With a plate camera on a stand proceed as follows:

1. Set up camera on stand and check adjustment with spirit-level.
2. Open camera and insert lens. Extend to infinity mark.
3. Open shutter and hood at back of camera (if any).
4. Focus roughly.
5. Compose image, adjusting movements as necessary.
6. Stop down and focus accurately.
7. Work out exposure, allowing for filter if one is to be used.
8. Adjust filter and lens-hood. Make sure that hood does not cut off corners of image.
9. Close shutter.
10. Check exposure calculation and set shutter.
11. Insert plate-holder.
12. Cock shutter.
13. Draw slide.
14. Make sure that camera is not vibrating.
15. Hold breath.
16. Release shutter with cable-release or ball and tube.
17. Replace slide and withdraw plate-holder.

The injunction to 'hold breath' in each case is not intended as a touch of humour. The moment of exposure is critical. Whether the exposure is long or short rock-like steadiness is vital. For hand-exposures

intense concentration is necessary and the camera must be 'fired' like a rifle. When a stand is used literal holding of the breath may not be necessary, but great care should be taken not to shake the camera, even with instantaneous exposures. A cable-release, especially a stiff one, is capable of imparting considerable movement if the operator is off his guard. In some ways the old-fashioned ball-and-tube release is better.

The length of the exposure has an important bearing on the probability of harmful shake. With hand-held shots the problem is relatively simple: all that matters is that the exposure should be short. For most people the practical limit with cameras taking negatives from 6 × 9 centimetres upwards is about $\frac{1}{20}$ of a second; the more phlegmatic may be able to keep still for twice that time. Miniature cameras with focal-plane shutters must be held still while the slit is crossing the film—a process which may take longer than the effective duration of the exposure. For eye-level shots the safe limit seldom exceeds $\frac{1}{100}$ of a second. With reflex and twin-lens cameras held at waist-level with a neck-strap exposures of $\frac{1}{50}$ of a second in the first case and $\frac{1}{25}$ in the second should be possible.

When the camera is on a stand the matter is more complex. Unlike the photographer, a tripod cannot brace itself at the critical moment. The slightest vibration caused by the opening of the shutter, or by the movement of the mirror in reflex cameras, is likely to be communicated to the whole assembly. The belief that a tripod necessarily gives security at all speeds is therefore false. It will only do so if the whole assembly is completely rigid, and in practice that condition

is seldom satisfied. Unless an exposure of the order of $\frac{1}{100}$ of a second can be given it may be safest, on occasions when the greatest possible sharpness is essential, to stop down so far that it becomes fairly long. Clearly, if releasing the shutter causes a vibration which lasts for $\frac{1}{10}$ of a second, the effect will be appreciable if the total time of exposure is $\frac{1}{5}$ of a second, but negligible if it is 50 seconds. On the other hand, in a wind it is usually best to keep the exposure as short as possible.

Where a delayed-action device is fitted it can sometimes be used to minimise vibration, especially with reflex cameras. As a rule the mirror flies up as soon as the device is triggered, and about 12 seconds then elapse before the shutter opens. In all but the worst cases the delay gives ample time for any shake arising from the movement of the mirror to die down. With other cameras the device serves a similar purpose when the cable-release has been mislaid and the shutter-mechanism has to be operated by direct pressure on the trigger.

Besides practising these drills and studying the points already mentioned, the novice can learn much about the image-forming capacities of his camera without wasting films or plates. This applies particularly to cameras with focussing screens or large brilliant finders, and still more to those with movements.

The following exercises are suggested:

1. Point the camera at an object and note the consequences of moving it laterally and up and down. A shift of a few inches may make a startling difference to the composition.

2. Tilt the camera upwards and note how the lines of the subject converge towards the top of the picture. The effects of slight tilting are nearly always disagreeable. On the other hand going close to the subject and tilting boldly may produce a striking effect which recalls the sensation of craning the neck sharply. This treatment is most likely to be acceptable when the outstanding feature of the subject is tallness or elevation. Where the subject has no marked vertical lines tilting has no noticeable effect.

3. If the camera has a rising front, point it at a tall object and raise the front until the top is in the picture. As a rule the elimination of the immediate foreground is an advantage and eases the problem of depth of field. Unless the lens has great covering-power an extreme rise may cut off the corners of the picture. Sometimes the half-extended bellows project into the field of view, but can be pushed or clipped out of the way. Lens-hoods and even the mounts of filters may also cut off corners, but should not do so if they have been carefully chosen to suit the lens. An adjustable hood of the bellows pattern is an advantage. If all else fails it may be necessary to remove the hood and do any shielding that may be necessary by holding some convenient object in a suitable position just outside the field of view. These discoveries should be made when practising, not after one has taken an important picture.

If the camera has a swing-front, lack of covering power may be partly offset by tilting the lens slightly, so that its centre points at the centre of the negative. Drastic stopping down will be necessary to make the whole image sharp, and a magnifier may be needed for the final focussing.

4. If the camera has a swing-back and tilt-front, try to get the same result either by tilting the front or by tilting the whole camera and restoring the back to the vertical position. Re-focussing and stopping down will be needed to get the image sharp. Alternatively, with some cameras when the swing-back is used the top of the front can be swung forwards so that the lens-panel is parallel with the back. The effect is then the same as if the front had been raised to an extreme degree.

5. Tilt the camera downwards and try to get images of objects on a lower level without objectionable convergence. As in the opposite case, convergence is permissible if the camera is sharply tilted. Otherwise, by using the swing-back and swinging the lens-panel parallel with it the effect of a falling front can be obtained. Note that convergence is least apparent with long-focus lenses and a distant viewpoint.

6. Tilt the camera downwards at an oblique angle to a level surface such as a table or a lawn. Focus on the furthest point in view. Swing the back from the bottom until the foreground is also in focus, adjusting the focus if necessary. By this means landscapes and still-life subjects can sometimes be photographed at large stops. The method does not work well if there are tall objects in the foreground or middle distance, but gives great depth of field where everything but the background lies in roughly the same horizontal plane. Landscapes with lakes or other prominent objects at ground level a few feet from the camera and mountains in the far distance can thus be photographed with relatively large stops and exposures short enough to avoid the blur which would otherwise be caused by waving grass or windswept water.

Seascapes with breakers in the foreground obviously call for the same treatment. A rough but fairly reliable rule is to assume that an exposure of $\frac{1}{100}$ of a second or a little less, although it will not eliminate all blur, will reduce it to a reasonable compass, leaving enough to show that the water was in motion. Gently waving grasses, unless very close to the camera, can be successfully photographed at $\frac{1}{5}$ of a second by choosing the right moment. For grazing animals and people walking in the middle distance an exposure of $\frac{1}{50}$ to $\frac{1}{100}$ of a second should suffice. Moving objects within a few feet of the lens, athletes running or jumping and fast-moving vehicles call for much shorter exposures. Although rules to cover such cases are often laid down, in practice so many factors must be considered that the only sound procedure is to give the shortest exposure that the speed of the film, the state of the light and the depth of field needed will permit. Much can be done by choosing the moment when the horse is at the top of its jump or the object in other respects in the most favourable position in relation to the camera.

7. If the front of the camera has a sideways movement or 'cross-front', note the effect of this movement when the camera is pointed at an object with marked horizontal lines. When a building must be photographed from a fixed viewpoint, such as a door or window, it may enable the photographer to include the whole frontage while keeping the back square to the main plane of the subject, and thus to avoid the horizontal convergence which would result from turning the camera. Although the eye normally accepts horizontal convergence without question, there are cases where it would be disturbing. An example is a

classical façade intended by the architect to be seen from a particular viewpoint. In other cases the photographer may not only be tied to a particular viewpoint, but also be prevented by some obstruction from turning his camera, even though there is no aesthetic objection to his doing so. Here again the cross-front may be the only answer to the problem.

Most plate cameras have either a 'reversing' or a 'revolving' back so that either upright or horizontal pictures can be taken without reversing the whole camera. In its absence the cross-front serves as a rising and falling front when the camera is on its side. A feature often regarded as superfluous then becomes a virtual necessity. Accordingly, anyone buying a camera for architectural photography should make sure that it has either a reversing or revolving back, or a cross-front, or both. The swing-back and swing-front are less important.

8. If the camera has no movements, try to find positions from which chosen subjects can be photographed without tilting. General views of buildings are possible if the photographer can raise himself on a convenient wall or slope. Details can often be taken with a miniature camera boldly tilted.

9. Practise judging the distance of objects within 50 feet and check the results by measurement. A good plan is to learn to recognise certain distances—say 6, 12, 15 and 30 feet. The reader who finds that he has no aptitude for judging distances by eye should buy a pocket range-finder calibrated in the same units as the focussing-scale of his camera, unless a coupled range-finder is fitted. Even at small stops the depth of field at short ranges is so shallow that accurate focussing is vital.

SUBJECT AND TREATMENT

BEFORE he can take good photographs the novice must not only study the handling of his camera, he must also study the subjects he intends to take. He cannot do so with advantage unless he has some understanding of the limitations of photography and the problems which arise in interpreting the visible world in terms of the photographic print.

Many people believe that they will never be able to take good photographs because they lack the artist's eye. They forget that, although the artist's eye may be partly a natural gift, it is largely an effect of professional habit, and that habits can be acquired. All that is needed is to get into the way of seeing objects in terms of the pictures that can be made of them. The daily scene abounds in subjects suitable for graphic representation, but most of us do not see them because we are not accustomed to look at them in the right way.

Most of the scenes and objects which confront the photographer are solid. A photographic print is flat. Moreover, the whitest paper reflects only about fifty times as much light as the blackest mark that can be made on it. The brightness-range of natural scenes and objects, on the other hand, may be anything from about 1 to 4 to 1 to 1,000 or more. The central problem of photographic representation—as of drawing or monochrome painting—is therefore to depict the solidity and tonal range of the subject within a narrow compass. Critics and philosophers are fond of debating whether art is imitation, but to the artist

aware of these simple facts it is obvious that his work can never be anything but a highly artificial equivalent of the natural world. Nevertheless a good photograph or drawing can and should interpret the subject so convincingly that this highly artificial equivalent is more satisfying and seems in a sense more real than the original.

The problem of interpreting the tonal scale of the subject within the 50 to 1 range of the printing-paper is usually met by using the full range of the paper, irrespective of the subject. Although there are exceptions, a good print usually shows something approaching a full white as well as a full black. The values of a subject of high brightness-range are therefore compressed and those of a subject of a low brightness-range expanded. In the second case it would be possible to make a print which reproduced the flatness of the original, but in all probability the result would not be agreeable to the eye or give a convincing impression of the subject.

The methods needed to achieve this end are straightforward and are described in Chapters III, IV and V. Meanwhile the reader should understand that it is no use attempting the impossible and that he may have to take account of the limitations of his equipment as well as of those inherent in the photographic medium. On any fine day in the summer one can see beginners with box or folding cameras attempting subjects which the most accomplished expert with all his technical resources would hesitate to tackle.

Subjects of extreme contrast, embracing deep shadows and unscreened lights, cannot be photographed by any ordinary means and should be left alone. Subjects of exceedingly low contrast, such as

open landscapes in dull weather, can be undertaken with plate cameras by the means described in Chapters III and IV, but usually not with small cameras using roll film or 35-millimetre film. Apart from the smallness of the negative, the user of a roll-film camera is limited by the necessity of giving the same development to every exposure on the roll. In consequence his negatives will vary in contrast according to the contrast of the subject. Choice of the right paper for printing will bridge moderate variations in negative contrast, but not great ones. Even if he were to sacrifice the rest of the roll in order to photograph a few subjects of exceedingly low contrast he would be unlikely to succeed, because the treatment required to produce a negative of satisfactory printing contrast from such subjects is not compatible with the very fine grain demanded of small negatives.

Users of roll-film and miniature cameras should therefore confine themselves to subjects of moderate to fairly high contrast. In the open air portraits, figure-studies and buildings fairly near the camera can be tackled in reasonably bright, diffuse light because even when the sun is not shining the pools of shadow under brows, chins and porches, as well as variations in colour and surface texture, usually give moderate to ample contrast. Landscapes and buildings more than 50 feet away should normally be attempted only when the sun is shining. In general, a brilliant but not harsh illumination is best. In spring and autumn, and on sunny days in winter, these conditions are usually present throughout the daylight hours in good weather; in summer the noonday sun is often too harsh and photographs are best taken before ten or after four o'clock. The sun should not be directly behind

the camera, for in that case the lighting, although brilliant, will also be flat. As a rule the source of light should be slightly behind the photographer and to one side; but any position which reveals both a shadowed and a sunlit aspect of the subject is satisfactory. Evening and early morning sunshine are ideal, for long shadows make interesting patterns and the texture of rough surfaces lit by slanting rays is clearly shown. The aim is to make solid objects look solid in the photograph; hence their shadowed as well as their sunlit faces must be shown.

If, in defiance of these rules, it is necessary to take photographs in midday summer sunshine, a vivid impression of solidity can sometimes be got by standing so that the sun is almost directly opposite the camera. Even with a lens-hood it will usually be necessary to stand in the shadow of an overhanging tree in order to prevent the sun from shining directly on the lens. If the subject is a building the front which faces the camera will be in shadow, but a sloping roof and a side wall may catch the light and be brilliantly illuminated, giving an effect of strong relief. Statues and architectural details can be made to stand out from their surroundings in the same way if a viewpoint can be found from which parts of them appear brightly lit against a darker background. With minimum exposure landscapes often respond well to this treatment, sunlit fields, the tops of trees and translucent foliage standing out brilliantly against the deep pools of shadow under trees and hedges. Against-the-light effects can also be used when the sun is lower in the heavens, but in that case it will nearly always be necessary to stand so that the sun is directly hidden by some object which will be rendered

virtually in silhouette. Strong lighting effects are particularly suitable for miniature photography, because the kind of development they demand is precisely that which is normally employed with miniature negatives to give fine grain.

Users of plate cameras have a wider choice of subject and viewpoint. They can use their movements and interchangeable lenses to include the chosen part of the subject from almost any angle and can adjust development so as to obtain a negative of the right contrast irrespective of the lighting. For commercial photographs, where the aim is to show all parts of the subject with the utmost clarity, diffuse lighting may be preferred: there are few or no cast shadows to obscure the detail, and the full range of the printing paper can be used to bring out the subtle tonal differences due to variations in texture and local colour. On the other hand, where bold treatment and strong lighting effects are appropriate they can proceed in exactly the same way as users of roll film and miniature cameras. Even subjects of exceedingly high contrast can be undertaken with special methods of development; but in extreme cases some means of lighting the shadows artificially may be needed.

So far it has been assumed that the photographer can choose his lighting, taking outdoor portraits in bright but cloudy weather and landscapes and general scenes when the sun is shining. In practice these conditions may not be realised. Even so the situation is not hopeless. Landscape photography with small cameras is not often practicable in bad weather unless heavy storm clouds and shafts of lurid light diversify the scene, but outdoor portraiture in brilliant sunshine, although more difficult than many beginners

realise, is not ruled out. The difficulty arises from the harshness of the contrasts between sunlit cheeks and brows and the heavy pools of shadow round eyes and under noses. The contrasts can be lessened by full exposure and short development, but this treatment does not always meet the case and is generally impracticable with roll film.

The obvious remedy is to throw more light into the shadows. A method which has had some vogue in recent years is to use a flash-bulb mounted on the camera. A synchroniser or flash-gun is necessary and must be so adjusted that the light from the flash-bulb reaches its peak intensity as the shutter opens. There are many outfits on the market, but not all are suitable for all cameras. The advice of a reliable dealer should be taken and if necessary the camera, or at any rate the lens and shutter, should be sent to the factory for synchronisation. The stop and distance from camera to subject must be worked out from the data supplied with the bulb so that the light balances properly with the natural lighting.

The disadvantage of the synchro-sunlight method are the cost and bulk of the equipment and flash-bulbs, the necessity for accurate last-minute calculations, the possibility of expensive errors and the obligation to take the photograph from a distance dictated by the lighting conditions. A simpler if less efficient method is to use a reflector. A piece of white card not less than 20 inches square, a similar card covered with silver-paper, or a mirror can be placed or held near the subject and will reflect a good deal of light into the shadows. If the camera has a delayed-action device and is on a tripod the reflector can be held by the photographer. An obvious objection is

that a holiday-maker who intends to make a few informal snapshots of his companions is usually unwilling to burden himself with large pieces of card or mirrors. Alternatives are a white scarf or towel, a person in light clothes standing near the subject, or even a newspaper held by the sitter as if he had just looked up from reading it. At the seaside and near lakes and rivers so much light of high actinic quality is reflected from the water that it often suffices to pose the sitter on the margin. Elsewhere advantage can be taken of the light reflected by a sunlit wall. On board ship, in boats and on rafts, piers and jetties artificial reflectors are seldom needed and portraits can be taken in the most brilliant sunshine without much fear that the result will be too harsh. Care should be taken not to over-expose, and a pale-yellow filter should be used to cut out some of the excess blue-violet light which is always present in the neighbourhood of snow and water.

Indoors the photographer can control his lighting and photography becomes easier than it seems to the uninitiated. The principles are the same as out of doors, although the practical differences are considerable. In the open air, when the sun is shining, objects are lit both by the direct rays of the sun and by light reflected from clouds, buildings and other objects and diffused by the atmosphere. Objects in the shade are fairly well illuminated unless they are deeply overhung by projections which exclude most of the indirect as well as the direct light. Additional lighting for the shadows is therefore necessary only in special cases such as portraits, where cavernous areas like the eye sockets must be clearly shown. When the sun is not shining objects are lit entirely by diffuse and reflected light.

Indoors without artificial light the sole source of direct light is the window, and the amount of indirect light reflected by walls and furniture is fairly small. If there are windows in more than one wall, or, better still, if there is a skylight, the conditions approximate more closely to outdoor lighting, but the difference is still great. Both ends of the lawn receive precisely the same amount of illumination from the sun's rays if they are both in sunshine, but indoors the wall and floor 10 feet from a small window receive only a hundredth part of the direct light received by an object 1 foot from it, plus a small amount of reflected light. Consequently indoor photography raises problems outwardly formidable, although usually not very hard to solve.

Photography of large interiors such as cathedrals, public halls and rooms of state is possible without artificial light because the architect has been at pains to light them evenly. Although it may be dim, the light from windows, domes and lanterns is or should be well distributed. Even so, precautions must be taken against harsh contrasts. As such subjects are nearly always photographed with plate cameras which allow each negative to be treated separately, the situation is met by adjusting the exposure and development and in some cases by using a plate or film of inherently soft gradation. These aspects are discussed in Chapters III and IV. Elsewhere, at home or in the homes of the photographer's friends, most difficulties can be swept aside simply by using artificial lights so arranged as to give any degree of subject-contrast that may seem desirable.

By far the simplest and generally the cheapest sources of artificial light for photography are the

photoflood bulbs mentioned in Chapter I. Flash-bulbs or 'speed-flash' equipment are better if very short exposures are needed to record subjects in rapid motion; but action photography by artificial light is not a field in which the average reader can hope to compete with the experienced and fully-equipped press photographer, nor is it likely to give results of much aesthetic interest unless he can afford to devote time, thought and money to 'multiple flash' effects which call for a good deal of study. Readers who are drawn to the subject are referred to the excellent book *Photo-flash in Practice*, by Geoffrey Gilbert, published by the Focal Press.

Apart from cheapness and simplicity, the advantage of photofloods is that they enable the photographer to study his effects at leisure before making the exposure. For portraits and still-life studies the standard method is to arrange one bulb in a reflector a few feet in front of the subject and to one side, so that the light bears down at an angle of about 45 degrees to the line joining camera and subject. A second photoflood, also in a reflector, is put near the camera or in line with it to lighten the shadows. In the daytime the light from a window can be used instead of the second lamp. If the lamps give too intense a light they can be moved further away or obscured by sheets of gauze or tissue paper, or by specially made diffusers designed to clip on to the reflectors. As a good deal of heat is generated, fireproof materials are safest. If necessary a third lamp, hidden by the subject, can be used to light the background. For portraits an additional lamp directed downwards to light the sitter's hair is sometimes useful. A spotlight, designed to focus a fairly narrow beam of light on to the subject or some selected part

of it, is a valuable but rather expensive and not essential tool. Many other arrangements are possible, but in general the principle of one lamp to light the subject at an oblique angle and a second to relieve the shadows should be observed. Time devoted to trying out various arrangements is well spent even if no photographs are taken. As a measure of economy ordinary 60-watt bulbs can be substituted for the photofloods during these experiments.

Care must be taken not to fuse the circuit by overloading it. Most domestic circuits will take at least two photofloods and give an ample margin to cover the chance switching on of other lights. If more are to be used, or any doubt is felt, the advice of an electrician should be sought.

For architectural interiors the arrangement of the lights can be governed by the simple principle of giving adequate lighting to all parts of the subject. As a rule these subjects present such a variety of surfaces with different reflecting powers that there is little risk of killing the contrast by excess of light. On the other hand, care should be taken to suppress dazzling reflections from highly polished articles. If several lamps are used they should not all be massed near the camera, or the foreground will get too much light in relation to the background. If the subject has considerable depth it will probably be necessary to place lights at strategic points between the camera and the far wall, arranging them behind pieces of furniture or projecting features so that they are not directly visible. Combinations of daylight and photofloods to light up dark corners are often useful, as well as ordinary electric lamps. Any lights included in the photograph should be switched on for only a brief part of the

exposure. In daylight, when windows are included, a favourite stratagem is to draw the curtains, make the main exposure by artificial light, then close the shutter, pull back the curtains, and make a further brief exposure. Great care must be taken not to move the camera between exposures. Unless the curtains project some way below the bottoms of the windows the image of them recorded by the first exposure will be obliterated by the image of the windows recorded during the second exposure, and the effect will be quite natural. Such subjects are usually taken with lenses stopped down as far as possible, so that exposures tend to be rather long and there is a fair margin for error.

Practical problems likely to arise in photographing these and other subjects are discussed in the chapters on exposure and development and in Chapter VI. Meanwhile, the reader is urged to study many more subjects than he photographs, noting the differences in light and shade between their various parts and trying to interpret them mentally in photographic terms. The key to photography is the ability to judge by looking at a subject how it will photograph and what technical adjustments are needed to bring out its essential character. That ability cannot be acquired without thought and study as well as practical experience. We are told that the conductor of an orchestra, when he reads a score, hears mentally the sounds that the various instruments should make. There is a rough analogy in photography. Even if he has nothing more than a box camera, the photographer who is not content with happy accidents should try whenever he looks at a subject to see in his mind's eye the finished picture as it will be and as it ought to be.

Before we can make convincing photographs we must form the habit of seeing the various and solid world in terms of the flat bromide print, with its limited range and lack of colour.

3

PERSPECTIVE AND COMPOSITION

THE IMPRESSION of depth and solidity in a scene drawn or photographed in monochrome is given by:

1. Differences of light and shade which suggest the form and contour of the objects depicted. If a wall is shown in sunlight and another wall which meets it is in shadow the inference is that they are in different planes and enclose a solid angle. But the differences may be obscured and the inferences be invalidated by cast shadows and variations in local colour. If the sunlit wall were painted a dark colour it might be rendered in the same tone as the shadowed one. In the absence of other indications it would then be taken to lie in the same plane.

2. The softening of contrast and lightening of shadow tones in the rendering of distant objects through the scatter of the light-rays by the intervening atmosphere. Sometimes called 'aerial perspective', the effect is most marked in damp climates and hardly noticeable in hot, dry countries. It tends to be exaggerated by the camera but can be controlled by filters.

3. Perspective. The eye draws inferences from the scale on which objects are depicted and from the convergence of horizontal lines such as the tops and bottoms of walls, doors and windows and the edges of

paving-stones and roads. Here again the spectator may be tricked by the conjunction of objects apparently of the same size but really of different sizes, and by convergences inherent in the subject; but this does not happen very often.

The most important of these means are the first and third. Because of its variability and because it is appreciable only over a considerable distance, aerial perspective is not a very reliable way of indicating depth. It has its place in landscape photography, but that place is a small one. In Great Britain and northern Europe the photographer's chief concern with it will be to see that too much of it does not interfere with clarity. We are therefore left with tonal differences and perspective. Indoors we can control them to a large extent by arranging the subject and lighting as we choose. Out of doors we can usually do so only by a choice of lens and viewpoint and, apart from using flash-bulbs or reflectors, by awaiting the moment when nature provides the right illumination. These limitations may seem severe, but in practice the amount of control which can be so exercised is remarkable. In either case, whether indoors or out of doors, the photographer's aim should be so to choose his viewpoint that tonal differences and perspective combine not only to make objects stand out one from another, but to show them in their correct relationship so that the space between them can be almost felt. Except on the comparatively rare occasions when a flat pattern or silhouette is sought this is the major part and most important aspect of photographic composition. It can be learnt only by looking at natural objects, preferably with one eye closed, and

noting the effects of line and tone which make them appear solid.

Another aspect is the arrangement of the lines and tones that make up the pictorial image so as to form an abstract pattern on the flat surface of the print. Books and critical writings on pictorial composition are generally concerned solely with this aspect. Their authors are at pains to analyse photographs, drawings, paintings and other graphic representations in terms of S-curves, diagonal compositions and other two-dimensional shapes. Many attempts have been made to formulate rules of composition in this restricted sense for the benefit of critics and artists, but while the former have found them valuable the latter have usually preferred to compose by eye. The following axioms may, however, be found useful:

1. When the subject includes a principal object and a number of secondary objects, a safe plan is to put the principal object about a third of the way from one edge of the picture and dispose the secondary objects so that their common centre or 'centre of gravity' is about the same distance from the opposite edge. Compare the placing of the cactus and the common centre of the pine-cone and cigarette-box in plate 18.

2. In general, lines connecting points a third of the way along from the corners of the picture, and their points of intersection, are good places for marked accents. In plate 18 the middle of the cactus and the common centre of the flower-pot and saucer are a third of the way along from the left-hand edge of the picture and also a third of the way from the top and bottom edges respectively. The common centre of the

pine-cone and cigarette-box is in the corresponding relation to the right-hand and bottom edges. The same principle can be applied to landscapes. For example, the horizon might be placed on the lower horizontal third, a tall tree on the right-hand vertical third and a clump of bushes or a cloud where the left-hand vertical third cuts one or other of the horizontal thirds. Subtler effects might be obtained by balanced displacements from these positions. In any case, the effects should be judged by the eye and not by measurement.

3. Persons, animals and vehicles represented as moving or gazing laterally across the picture should generally have more space in front of them than behind them. In other words, they should be shown as travelling or looking into the picture and not out of it. This simple and apparently arbitrary rule can seldom be broken with impunity.

4. Objects depicted against a plain or quiet background generally need to be linked together in some way. In plate 16 the balls of string are linked both by the shadow of the further ball and by the loose end which curls from it round the nearer ball. A more varied background may itself provide the link. A number of similar objects against a plain background may be sufficiently associated by a lighting arrangement which causes them to throw similar shadows on to it.

Many more examples might be given, but since the object is to encourage the reader to use his eyes it is better that he should discover such points for himself with the help of the suggestions already made. He should look at natural subjects, study the fall of light and shade upon them, and consider what view-

point will best bring out their essential character and their relationship to surrounding objects. The principles are the same whether the subject is a mousetrap, a woman's face or the Himalayas. In arriving at an arrangement which renders the subject convincingly he will also achieve a satisfactory composition. This may seem surprising, but when one remembers that nobody could hope to hit a moving ball or whistle a tune if he directed his mind consciously to the muscular adjustments required it is perhaps not so strange that composition is best left to the eye and to what we usually call taste or instinct. The reader is again reminded that these faculties are not really instinctive but must be cultivated by studying natural objects and pondering their interpretation.

The beginner may be surprised at the suggestion that he should confine himself to such severely objective matters as the fall of light and shade upon the subject. He has perhaps been told elsewhere that he should cultivate a personal approach, strive for an individual interpretation or try to evoke some special magic or 'atmosphere'. Where aesthetics are concerned there is room for many opinions, but such subjective approaches do not seem likely to be fruitful. Although the graphic artist is usually represented by novelists as concerned to express either his own personality or some mysterious essence residing in his subject matter, his business is primarily with the visual and tactile qualities of the latter. He is apt to be indifferent to the literary, metaphysical or romantic overtones which give his work value in the eyes of his admirers. Portrait painters and even portrait photographers are sometimes praised for their skill in bringing out the hidden character of the sitter; but

as for the artist the essential character of a subject is that which is not hidden but revealed on the surface, the suggestion that he has forsaken his true aim in order to penetrate beneath the skin is a doubtful compliment. If the sitter has a candid gaze but the painter thinks him cunning he can paint him with a sly look, and the photographer can arrange his camera and lighting to produce a similar effect. But by doing so he leaves his proper field and enters the doubtful realm of the psychologist.

The reader is therefore urged to concentrate his interest on the subject and think only of rendering it as clearly and convincingly as possible in what seems to him its most significant or important aspect. Attempts at romantic interpretation or self-expression usually defeat their object. For nearly forty years the pictorial movement, by fostering false notions of the picturesque, effectively damned photography in the eyes of the educated public. It was only when photographers stopped trying to be unphotographic and accepted the virtues and limitations of their medium that people of taste began to look at photographs again and recognise their merits. To hope that one's work may bear an individual stamp is a harmless aspiration, but to strive consciously towards that end is unnecessary as well as harmful. No matter how conscientiously the photographer aims at an objective and impersonal rendering, his choice of subject-matter and treatment will infallibly reflect his outlook, tastes and interests. Style is not something added to the work; it is inherent and survives all attempts at its suppression.

The problem of depth of field may cause some difficulty and deserves a further word or two of

explanation. A sound rule is that everything in the picture should be sharp. Conditions are ideal when the lens can be focussed on the most important part of the subject and then stopped down so that everything from the immediate foreground to the furthest distance is within the depth of field. But this treatment is not always practicable. Suppose the most important part of the subject is a building 40 feet away, the field of view starts 12 feet from the camera and extends to the far distance, and we are using a 4-inch lens. With the lens focussed at 40 feet even the smallest stop will not bring the foreground within the depth of field. The table in appendix A shows, however, that if we set the lens at 21 feet we can satisfy the conditions with the moderate aperture of f/16, so that if the light is good a hand-exposure will be possible. Conversely, if the most important part of the subject is 12 feet from the camera, an exceedingly small stop would be needed to get the far distance within the depth of field by focussing at that distance. But by using the same setting as before we can again take the picture at f/16. In the first case the plane of critical focus will be nearer than the main object, and in the second case further away. Owing to the slight camera-shake which is seldom avoided even with a tripod, there is almost certain to be a perceptible decline in sharpness near the theoretical limits of the field. Consequently we must use the depth-of-field tables with discretion, choosing a stop which will not make it necessary to focus too much in front of or behind the main object in order to get the other objects reasonably sharp. A lack of pinpoint sharpness in the far distance is usually permissible, but a fuzzy foreground is always bad.

The reader may perhaps have been told that for portraits he should use a large stop in order to subdue the background by throwing it out of focus. If there is no time to arrange the sitter properly, this advice may be followed and the plainest and least obtrusive background should be chosen. A canvas screen or a cloudless sky need not be sharp. But if the background contains recognisable objects and adds something to the picture it should be sharply rendered. The sitter should be made to stand out from it by proper lighting and a correct choice of viewpoint, not by throwing part of the picture out of focus. With small negatives special care should be taken to avoid out-of-focus areas, for when greatly enlarged they tend to look grainy as well as fuzzy.

CHAPTER III

EXPOSURE

I

PRINCIPLES

MANY PHOTOGRAPHERS fail through attempting subjects unsuitable for their equipment, others because they do not separate their principal subject from its surroundings. Users of small cameras, turning their backs on subjects which ask to be photographed, attempt open, flatly-lit scenes, or depict their sitters with trees apparently sprouting from their heads or with faces obscured by deep shadows. Others forget to focus properly, unwittingly turn the camera off an even keel or shake it at the crucial moment.

Those mistakes can be avoided by following the suggestions made in Chapter II, and, above all, by studying the subject carefully before making the exposure. Choose a viewpoint which reveals the shape of the main object clearly and also its position in relation to other objects in the picture. Then, and not till then, take out the camera, compose the image carefully on the ground-glass screen or in the view-finder, focus accurately and, having cocked the shutter, hold the camera still and level while releasing it. Do not try to compress the immensity of a cathedral or the view from a great height on to a tiny negative, but choose some detail of the scene and approach it at close quarters. Unless the camera is fairly large,

open scenes should be attempted only when they are lit by strong side-lighting.

All these points may be observed, but there still remains the problem of exposure. Dealers who develop large numbers of films for amateur photographers report that in winter most of the negatives they handle are under-exposed, while in summer about the same proportion are grossly over-exposed and consequently too dense to make good enlargements. Yet in half an hour and at the cost of a few shillings anyone can learn enough about exposure to avoid gross errors at least nine times out of ten.

When the shutter is opened to make the exposure or 'take the picture', it is for the purpose of allowing the image cast by the lens to fall on to the film or plate and impress itself on the sensitive emulsion. As the brightness of the image is not uniform throughout the picture, but varies from one part to another according to the amount of light reflected by the different parts of the subject, in effect the film or plate receives not one but many exposures. Those parts of it which correspond to the bright parts of the subject receive most light, those parts which correspond to the deepest shadows least. The whole art of exposure lies in opening the shutter for a sufficiently long time to ensure that the dimmest parts of the image are adequately recorded, and no longer. The time required may be anything from $\frac{1}{1000}$ of a second to many minutes, but the principle is the same in every case.

This is a point which even quite experienced photographers often fail to grasp firmly. As some parts of the image are relatively dim and others relatively bright, it is natural to suppose that the length of the exposure should depend on the average brightness.

This is a misconception. All that matters is the brightness of the darker parts. If the darker parts are properly recorded, correct development and the skill already expended by the maker of the film or plate will take care of the rest.

Although in practice there are apparent exceptions to this rule, they do not invalidate the principle, which holds good for all exposures. Sometimes the photographer may prefer to under-expose the deepest shadows in order that they may appear as plain glass or blank celluloid in the negative. But first he must know what exposure would be needed to record them as something more than plain glass or blank celluloid, and then give less. Conversely, it may sometimes be desirable to give a longer exposure than would record the shadows as only one step above plain glass or blank celluloid, and thereby push the whole image up the scale; but here again, it is first necessary to know what exposure would suffice to record them normally, and then give more. Other procedures, which may seem to depart even more radically from the principle just laid down, will be described later in this chapter. But all of them can be traced back ultimately to the golden rule, *expose for the shadows and develop for the higher values*. For the moment we are concerned only with the first half of this rule.

It follows that the first step towards correct exposure is to determine the brightness of the dark parts of the subject. Many methods of arriving at this result have been suggested, but only five are in common use at the present time. They are:

1. *Guesswork.* This is the worst possible method. The eye is a bad judge of brightness, for it quickly adapts

itself to variations and is left with no fixed standard to refer to. Looking at the image on the ground-glass with the head under a focussing-cloth is better than looking directly at the subject, but the method is only suitable for large cameras and needs a long experience of trial and error.

2. *Optical Exposure-meters.* The dark parts of the subject are looked at through an optical device which is adjusted until they are barely visible, or the dimmest or numerically lowest figure of a number seen successively or simultaneously in the field of view is selected as an index of the brightness-value. The advantage of optical meters is that they work in very dim as well as in bright light. Their weakness is that the readings obtained depend to some extent on the personal factor and on the conditions in which the device is used. The second difficulty can be largely overcome by making an allowance for the general lighting conditions prevailing at the time. Some experience with visual meters is necessary to get full value from them.

3. *Exposure Tables.* These are cheap and take up little room. If intelligently used they ensure that the exposure will not be grossly insufficient. Their use is discussed in the next section of this chapter.

4. *Photo-electric Exposure-meters.* The most accurate device obtainable at a moderate cost. Bulkier than tables and more expensive than optical meters. The use of photo-electric meters is described in section 3 of this chapter.

5. *The S.E.I. Photometer.* Enables readings to be taken on minute areas of the subject, even at relatively long ranges, and should make correct exposure a matter of certainty. The relatively high cost puts it out of most

people's reach for everyday use, but for the expert it is a valuable tool. Particulars can be had from dealers or from the distributors, Ilford Ltd, of Ilford, Essex.

EXPOSURE TABLES

THE PRINCIPLE of exposure tables is quite simple. From knowledge of the calendar the position of the sun at any time of the day and year can be accurately predicted, and by making a correction for the state of the sky we can estimate the amount of light which reaches the subject. Since it is not the amount of light which reaches the subject that counts, but the amount reflected by its darkest parts, a further correction must then be made for the nature of the subject. Both corrections involve some risk of error, but by introducing a sufficient safety factor the calculation can be so framed that at least the exposure is not likely to be underestimated. The only other factor that need be considered in daylight is the speed of the film or plate.

Calculators with which the corrections can be made in a second or two can be bought for a few shillings. They are strongly recommended to those who do not possess or wish to buy a photo-electric meter. A good example is that incorporated in the Johnson 'Wellcome' *Photographic Year Book*. It is based on generally accepted standards published by the British Standards Institution. The *Year Book* costs less than the price of two panchromatic roll films. As it includes a space for recording exposures as well as a diary and a good deal of useful information, a personal opinion is that

it is good value for money. Throughout the rest of this section it will be assumed that the reader possesses this calculator or one based on the same principles.

The method of operation is extremely simple. The user begins by looking up the light-value for the time of the day and year and the state of the sky in the appropriate table. He sets a dial so that the value lies opposite a number which corresponds to the speed of the plate or film. The exposure at any stop for an ordinary subject fairly near the camera can then be read off at a glance. The exposure for other subjects is found by making a second turn of the dial.

Calculators of recent manufacture often introduce a considerable safety factor. If the subject is of moderate contrast it may be safe to give two-thirds or one half of the indicated exposure. If the subject is of low contrast still less may suffice, but unless the negatives can be developed one by one such subjects are best left alone. On the other hand, if the contrast is high or if there is any doubt in the user's mind the full indicated exposure should be given. Over-exposure leads to coarser grain and less crisp definition than minimum exposure, but unless it is gross or big enlargements are wanted the loss of quality will be negligible. Severe under-exposure, on the other hand, is always a disaster. In a badly under-exposed negative the deepest shadows are rendered as blank celluloid or glass and the lower middle tones are crowded close together, while the higher tones are shown in their correct relationship. Such a negative can never be made to give a good print on any paper or by any artifice, for the gradation is uneven. A similar compression of the highest tones results from severe over-exposure, but the over-exposure has to be very severe

before it becomes apparent. Hence a safe rule is to give too much exposure rather than too little.

As lenses, shutters and methods of development vary considerably, the effective speed of a given plate or film with the reader's equipment may differ from the speed marked on the package. If he intends to base his exposures on the calculator he should begin by making tests. Take an average subject and give the indicated exposure: if the negative is too dense, give two-thirds to subsequent negatives, and if they are still too dense give one half. If the reader does his own developing and printing he can judge the right density by his ability to make good prints from the negatives with his own equipment. Otherwise he must seek the advice of the dealer who does the work. Remember, however, that the qualities desirable in a negative depend on the use that is to be made of it and are governed by development as well as by exposure. A negative which is quite satisfactory for contact printing may be inconveniently dense if big enlargements are to be made. Most commercial developing and printing firms make many more contact prints than enlargements, and unless warned that the enquirer intends his negatives for ultimate enlargement may judge accordingly.

Calculators are not only useful in daylight, they can also be used to work out exposures in artificial light. In that case the light-value must be found from a separate table which takes into account the strength of the main light and its distance from the subject. As shadows in artificial light are often darker and contrasts higher than they seem, less than the indicated exposure should not be given unless the user is quite sure of his ground. The same applies to photographs

taken by weak daylight indoors or out—and daylight indoors is nearly always weak. The eye adjusts itself to the poor illumination, and shadows which really receive little illumination seem well lit. A better idea of the contrasts can sometimes be got by half closing the eyes.

With a little practice the user of a calculator will learn to avoid all but minor errors in exposure and be able to laugh at the difficulties of those who expose by guesswork. With very small negatives, however, even minor errors are undesirable, at least if big enlargements are to be made. Negatives to be enlarged six, ten or even twenty times should receive the minimum correct exposure in order that the grain shall be as fine and the definition as good as possible. Where these conditions apply a photo-electric exposure-meter is recommended.

3

PHOTO-ELECTRIC METERS

IN PRINCIPLE photo-electric exposure-meters are more accurate than tables and calculators because they substitute measurement for estimation. A photo-electric cell responds to the light that falls upon it, its response is automatically measured and is indicated by a pointer. Nevertheless such meters are by no means foolproof, and the information they give is useless unless properly interpreted.

A few meters are designed to measure the light that falls upon the scene and are pointed from the position of the subject towards the source of light. The majority are designed to measure the light reflected by the subject and are pointed at it from the position

of the camera or from an intermediate position. The latter are more suitable for most purposes.

To be useful a meter should give reasonably accurate readings over a wide range of brightnesses. Its angle of acceptance should not much exceed the angle of view of a standard lens and should preferably be smaller, since a narrow angle favours selective readings. Its makers should provide facilities for repair and overhaul.

The widely-used Weston Master meter fulfils these conditions and is strongly recommended. It ordinarily measures reflected light, but can be adapted to measure incident light as well.

The simplest way of using the Weston or any meter which measures reflected light is to stand close to the camera and point it at the subject. Out of doors it should be tilted slightly downwards in order that the reading may not be unduly inflated by the light from the sky, which is usually much brighter than anything else in view. The meter then gives a reading which corresponds to the brightness of objects within its angle of acceptance. A dial adjusted for the speed of the film or plate translates this reading into terms of the exposure indicated for a given stop.

Apart from possible differences between the angle of acceptance and the angle of view of the camera lens, the obvious shortcoming of this method is that the value we really want is not the average brightness but the brightness of the shadows. Hence a correction for the type of subject may be necessary. It is usual to give the indicated exposure for a subject of average contrast; twice the indicated exposure for a subject of high contrast; and half the indicated exposure for a subject of low contrast. The reader is again reminded

that subjects of low contrast should not normally be attempted with small cameras.

Another method is to take a close-up reading of the main object. The meter should be held at a distance from the object which does not exceed its smaller dimension. Again only the average brightness is indicated and an allowance may be necessary.

A third method which has been suggested is to take close-up readings of the darkest and brightest parts of the subject and adopt the figure midway between them on the dial. The figure so obtained is not necessarily the correct minimum exposure but is usually quite safe. Where the photographer cannot get close enough to the subject to measure the brightness of its darkest and brightest parts, substitute readings can be taken on objects of similar tone and texture close at hand. Suitable substitutes might be the shadow on a dark path and a white card in sunlight.

A fourth method specially applicable to the Weston meter is to take a direct or substitute reading on either the darkest or brightest part of the picture and set the 'U' or 'O' position on the Weston dial opposite that value. The O method, although adopted by many photographers, would seem theoretically unsound since it controverts the accepted principle of exposing for the shadows. The U method is unassailable in theory, but in practice the darkest part of the subject is often a small area which does not permit of a direct reading and for which no convenient substitute may be available. A useful variant is to take a reading on a larger area—say the open shadow on a lawn—which is to be rendered two or three steps lighter in the print (and therefore two or three steps darker in

the negative) than the darkest shadow. The U position is then set against this value and the dial turned two or three steps to the left. For this purpose the numbered positions on the dial should be regarded as steps, and not the unnumbered intermediate gradations. The method works well in practice and is recommended as a means of ensuring the proper rendering of the lower middle tones, which is generally the main object of correct exposure.

If either the normal U method or this variant of it is adopted, the Weston meter can also be used to determine the correct development of films and plates destined for individual treatment. The procedure is as follows:

Take a reading on the darkest part of the picture or some part which is to be rendered two or three steps lighter, and set the dial accordingly. The correct exposure can now be read off. Suppose this brings the U against the value 6.5. The O will then lie against 800. Now take a reading on the brightest part of the subject. If the reading is 800 normal development is indicated. If it is less than 800 longer than normal development will be needed to bring the corresponding part of the negative up to the correct density. If it is more than 800 development should be less than normal in order to prevent the highest values from becoming too dense. Where the brightest part of the subject is to be rendered in the print as blank white, without tone or texture, the O reading can be taken on a part which is to be rendered one step lower.

Owing to the inherent limitations of printing-papers and variations in the performance of developers this procedure is not infallible, but it does give a fairly

accurate indication of the overall contrast of the subject, and thus suggest the degree of development required to bring the high values of the negative to the proper density. In any case, normal development is not necessarily that recommended by the makers of the film or the developer, but must be considered in relation to the photographer's own methods and equipment. In this connection the next two chapters should be read.

As several methods of using the meter have been described the reader may wish to be told which is best. A personal opinion is that in ordinary cases, where all the negatives on a roll or strip are to be developed together, the straightforward camera-position method gives the most useful combination of simplicity and accuracy, always provided that the indicated exposure is doubled for subjects of high contrast. Where negatives are to be developed individually and more control is wanted there is much to be said for the U-position method or some variant of it. In any case, the photographer should begin by determining the right setting of the meter for the film or plate in use. With a given lens and shutter a film with a nominal speed of Weston 24 may need a setting of 20, 24, 32 or even 16 or 40. The first step should be to make a series of test exposures at the different settings. The negatives should then be developed together in a standard developer and the setting which gave the best density should be taken as standard for that film, lens and shutter. If the developer is changed subsequently, another test may be desirable.

4

EXPOSURE IN PRACTICE

As THE subject of the last two sections is rather complex a brief recapitulation may be helpful. The important points are:

1. The correct exposure in a given case is the shortest that will render the darkest tones of the subject adequately in the negative. A longer exposure can usually be given without much harm, but the negative will then be denser than it need be. In consequence the grain may be coarser and the detail corresponding to the brightest parts of the subject be less crisply defined. Over-exposure is seldom harmful unless it is gross or the negative is to be greatly enlarged.

2. When the darkest tones of the subject are to be rendered as dead black in the print, exposure may legitimately be based on a tone higher up the scale, but the principle of basing it on the darker tones and not on the average brightness of the subject still holds good.

3. The brightness of the dark tones of the subject may be measured, or it may be inferred from the average brightness. The second method is less accurate but more easily applied.

4. Exposure tables and calculators do not measure the brightness of the dark tones. They estimate the brightness of the light which falls on the subject and apply a correction designed to ensure that its darkest tones shall not be under-exposed. As modern tables and calculators are often worked out with a large

safety factor it may be safe to give two-thirds or one half of the indicated exposure when the subject is of average contrast. If the subject is of unusually high contrast (and therefore has relatively deep shadows) the full indicated exposure should be given.

5. An exposure-meter pointed at the subject measures its average brightness and translates the result into a figure designed to give the shortest adequate exposure to the darkest tones of a subject of average contrast. If the subject is of higher contrast, twice the indicated exposure should be given. If it is of exceptionally low contrast, half the indicated exposure may be given, but such subjects are usually tackled only with plate cameras and additional development is given to compensate for the absence of inherent contrast.

6. Alternatively, a good exposure-meter can be used to measure directly the brightness of a chosen part of the subject. Either the darkest part or some part which is to be rendered a little lighter in the print than the darkest part should be chosen. Cheaper meters may not be sensitive enough to give accurate readings from small dark areas.

7. If the brightness of a dark area can be measured, the correct exposure can be determined without taking into account the contrasts of the subject. The photographer may, however, wish to have this information in order to decide what degree of development is necessary. He can do so by using the meter to measure the brightness of the brightest as well as the darkest part.

8. All meters and calculators assume the use of standard equipment and methods. In practice, the

performances of individual lenses and shutters differ widely. With different developers and methods of development films and plates may give more or less than their nominal speed. Tests should therefore be made to discover the right settings for the photographer's own needs. A film may have a nominal speed of Weston 24 or B.S.26°, but if he finds that to expose it correctly he must set his meter or calculator at Weston 16, Weston 32, B.S. 27° or some other figure, he should not hesitate to do so.

In everyday experience the chief difficulty in estimating exposure usually arises from the fact that all methods which rely on measuring or predicting average brightness require the photographer to make his own assessment of the subject in order to decide whether it is of more or less than average contrast. In practice even if average contrast could be defined it could not be recognised with certainty by any visual method. Out of doors and in bright light the eye often over-estimates contrast; indoors and in poor light it does the opposite.

With large negatives the difficulty can be met by giving a generous exposure and so ensuring adequate exposure of the shadows even at the cost of excessive density. This is done by always giving the full exposure indicated by the calculator, or twice the exposure indicated by a meter pointed at the subject from the camera, unless one is quite sure that the contrasts are not excessive. With small negatives, where correct minimum exposure is more necessary, two shots can be taken in difficult cases, one exposed for twice or four times as long as the other.

Undoubtedly a better method where accuracy is required is to avoid the necessity for assessing the contrasts of the subject by basing the exposure on direct measurement of the shadows. But this method is not always practicable. With a few exceptions like the S.E.I., exposure-meters are not capable of giving selective readings on small areas at a considerable distance, and substitute readings on objects close at hand may not be possible. Moreover, unless the substitute objects are carefully chosen to match the more distant areas the information so obtained may be exceedingly misleading.

It is therefore wise to recognise that the ideal methods of determining exposure described in text-books and manufacturers' leaflets are not always workable, and to be on the lookout for the traps that may be met.

In a sunlit landscape the contrast between the shadow under a hedge and a dazzling white cloud may appear extreme. The obvious conclusion is that at least twice the figure indicated by a meter pointed at the landscape should be given. But probably in the print the shadow can be legitimately rendered as a full black without detail, and the brightest part of the cloud as a full white. If those two tones are left out of account the contrasts appear quite low. Unless for some special reason the shadow is to be raised higher up the scale, the bare indicated exposure is ample and normal development suffices.

Indoors and in dull light the situation is often reversed. To eyes accustomed to the low scale of illumination shadows seem well lit, and, knowing that the lighter tones must receive less light than they would get out of doors, we conclude that the contrasts

are low. A photometer capable of selective readings would tell a different story. Probably at least twice the exposure indicated by the meter will be needed to render the shadows as anything but dead black in the print. If we want them to appear with the full detail and gradation which correspond to our subjective impression we shall have to push them further up the scale by giving a still longer exposure and cutting down development. Many developers give less than the nominal speed of the film or plate when development is cut down, and so the exposure may have to be increased still further. Moreover, when the image which reaches the film or plate is very dim, either because of the low brightness of the subject or because a small stop is used, its power to affect the emulsion is disproportionately reduced—a fact which must be recognised by giving about a third more than the theoretical exposure when the latter exceeds about 2 seconds. With all these factors to take into account, we may well find that four or five times the exposure indicated by the meter is not too much.

Variations between individual lenses and shutters should cause no difficulty if, as already suggested, tests are made to determine the *effective* speed of a given film or plate with the photographer's own equipment. Nevertheless, the reader should note that they are considerable, if only that he may be convinced of the need for tests. The highest speeds of many shutters are not more than half those marked, and sometimes they are much less. The marked apertures of lenses denote a statistical relation between the size of the hole and the focal length and do not directly indicate the amount of light that reaches the film or plate. Some light is always lost by absorption and reflection

within the lens; in a lens of high quality with six or eight glass-to-air surfaces it may amount to nearly half the quantity which strikes the front. Most symmetrical lenses employ more cemented and fewer glass-to-air surfaces, so that these losses are reduced. Thus a symmetrical lens with an aperture of f/6.3 may pass more light than an unsymmetrical lens at f/5.6 and almost as much as some lenses at f/4.5.

Internal absorption and reflection are much reduced by the modern practice of coating, which is therefore particularly valuable with lenses having a large number of glass-to-air surfaces. Besides increasing the total transmission, coating reduces 'flare', or the scatter of light from bright parts of the image into darker parts. It therefore increases contrast. If the same subject were photographed in identical conditions with a coated and an uncoated lens which passed the same amount of light, the coated lens would thus call for a longer exposure but give the more brilliant and crisply-defined picture. In practice a coated lens always passes considerably more light than an uncoated lens of similar construction in the same conditions, so that the loss of the scattered light by the dark parts of the image is more than offset and the coated lens is effectively the faster. Coating does not directly reduce flare caused by reflections within the camera (as distinct from the lens), nor does it render a hood superfluous.

When a lens is moved further from the back of the camera in order to focus on a near object, the brightness of the image is reduced and the difference may be great enough to call for a longer exposure. With small cameras the effect is negligible at ranges greater

than a foot or so, but with larger cameras it becomes apparent at those normally used for portraiture and still-life subjects. The appropriate increase can be calculated by measuring the extension, squaring it, and dividing by the square of the focal length. If an 8-inch lens is extended to 9 inches in order to take a portrait at 6 feet, the exposure should be $\frac{9 \times 9}{8 \times 8}$ or roughly 1.3 times the normal. When small objects are rendered full-size on the negative the lens is extended to twice its focal length and four times the normal exposure must be given.

Development may also affect the exposure by reducing (or even increasing) the effective speed of the emulsion. Developers intended to give particularly fine grain commonly call for an increase of about 50 per cent in the exposure time—a situation which is met by reckoning the speed of a film so developed at Weston 16 instead of Weston 24 or Weston 32 instead of Weston 50. Some fine-grain developers demand a still larger increase, up to three or four times the normal. Ordinary fine-grain developers give the full nominal speed of the emulsion and no departure from normal practice is required.

With a few exceptions developers not classed as 'fine-grain' give the nominal speed when development is carried to a fairly advanced stage, but some give less when it is curtailed in order to obtain a negative of normal gradation from a subject of unusually high contrast. In such cases the photographer can only hope for the best and give a little more exposure than he would otherwise think necessary. The difficulty can be very easily overcome, however, by using developers which do not suffer from this drawback. Examples are given in the next chapter

and in appendix C. Conversely, some special high-energy developers give rather more than the nominal speed, usually at the cost of coarse grain and false gradation. These, too, are dealt with in Chapter IV.

CHAPTER IV

DEVELOPING THE NEGATIVE

I

PRINCIPLES

WHEN THE shutter is opened to take the picture, the purpose is to allow the image cast by the lens to impress itself on the emulsion. The record so formed is invisible or latent. To make it visible and useful the negative must be developed. The first step is to convert those grains of the emulsion which have been struck by light—or some of them—into metallic silver. The second is to arrest the process by rinsing the film or plate in plain water or dilute acid. The third is to remove the undeveloped grains by treating it with a fixing solution and afterwards immersing it repeatedly in water. Having dried the plate or film by standing or hanging it up in a place free from dust, we are left with a negative whose areas of greatest density represent the lightest parts of the subject, and vice versa. However pleasing to the eye of the photographer, it is practically useful only as a step towards the paper print or positive transparency which constitutes the final picture.

The first point to grasp about development is that it is not instantaneous but progressive. When the film or plate is first put into the developer no change is apparent. After a time the parts of the image which correspond to the brightest parts of the subject make their appearance, then the middle tones and finally

the shadows. But once development has started metallic silver is added to the image in proportion to the amounts already present, so that it gains in contrast as well as in overall density as development proceeds. Eventually a point is reached at which the densities exactly reverse the brightnesses of the subject and the negative is said to have reached a relative contrast or gamma of unity. If development is continued further the contrasts of the subject will be exceeded, or, in other words, the gamma will be more than unity. Finally, the greatest contrast attainable by that particular emulsion in that particular developer will be reached. Thereafter fog caused by the development of grains which have not been struck by light will overspread the image, causing the contrast to diminish and ultimately blotting it from view.

At first one might suppose that the object of development would always be to attain the highest practicable degree of contrast, or in other words to change into metallic silver as many as possible of the grains struck by light and as few as possible of those not so struck. In practice we cannot often carry development so far because the resulting negative would be too contrasty to print on a modern paper. Unless the subject is of low contrast we shall probably need to stop development some considerable time before a gamma of unity is reached. Hence in modern practice, and especially with small cameras, it is important to use a developer which works well at relatively low degrees of development.

At this stage it will be instructive to compare the aims and methods of the straightforward commercial photographer, working mainly in the studio, with that of the general photographer who works largely out of

doors. So far as development is concerned the difference is fundamental and explains much that is puzzling in text-books and the instructions issued by manufacturers of films and plates.

Consider the case of an orthodox commercial photographer who is making a photograph of a piece of equipment to illustrate a catalogue. Indoors he balances his lights, or out of doors he waits for the sun to go behind a cloud, so that his subject is evenly illuminated and its texture and modelling are not obscured by cast shadows. In consequence its brightness-range may be as low as 4 to 1 and will probably not exceed 30 to 1 at most. He uses a large negative—probably whole-plate or larger—so he does not fear coarse grain or fairly high density. His main concern is that the tones of the subject shall be well and truly spaced out. He therefore gives a generous exposure, which puts the middle tones in the centre of the scale. As the brightness-range is low he runs little risk of over-exposing the higher tones. He then develops rather fully to obtain a negative whose density-range matches the exposure-scale of a normal paper. The result is a well-graded print of great forcefulness and brilliance. It is brilliant because the full 50 to 1 brightness-range of the paper is used to express the much smaller brightness-range of the subject, and so the differences of tone which indicate texture and modelling are strongly emphasised. Nevertheless the result is not always pleasing, particularly with outdoor subjects, where the lack of sunshine and cast shadows often produces an effect of coldness and austerity.

As a rule, the general photographer goes to work in a different way. Apart from probable limitations of

equipment which make low-contrast subjects and full development unsuitable, he generally prefers bold effects of light and shade which, rightly or wrongly, he may think more expressive. His outdoor work is likely to be done when the sun is shining and indoors he errs on the side of harsh lighting. A brightness-range which the commercial photographer would regard as high he would probably consider rather low; outdoors at least his average range may be of the order of 100 to 1 or higher. The average film can record brightnesses within a range of about 128 to 1 (or 512 to 1 including black and white) with reasonable fidelity, but its density-range must be compressed within the exposure-range of the printing paper, and in any case the subject will perforce be represented in the print within the 50 to 1 brightness-range of the paper. Somehow the photographer must continue to get a quart into a pint pot.

In photography there are broadly three ways of performing this improbable feat. The first and most orthodox method is to develop the negative to a low gamma so that its density-range is brought within the exposure-range of a normal or soft paper. All the tones of the subject will then be represented in the print but will be closer together in the print than in the subject. Theoretically such a rendering is unexceptionable, but in practice it may not give a good impression of the subject. The flattening of the scale may rob the picture of vitality and turn a vivid scene into a dull, uninteresting print. On the other hand it is safe and generally succeeds quite well. For this method a *soft-working developer* which gives good shadow-detail at an early stage of development is best.

The second and more dangerous method is to leave

out the lower end of the scale so that the deepest shadows are rendered as solid black and the lower middle tones severely compressed. Practically the whole brightness-range of the paper is then available to render the higher middle and high values. The method is justifiable only when the lower values are unimportant or take up very little of the picture.

The object is achieved either by deliberately underexposing the negative or by exposing it normally and printing it rather deeply on fairly hard paper. The second variant is generally preferable because it gives the photographer the alternative of making conventional prints on normal paper if they are needed for some special purpose such as a giant enlargement, where the areas of empty shadow acceptable in a smaller print would become obtrusive. In either case no special artifice in development is necessary and any normal developer is suitable. A soft-working developer as recommended for the first method is as good as any, and can usually be made to give any appropriate degree of contrast by adjusting the time of development.

The third and most subtle method is to give more development to the lower than to the higher values. The density-range of the negative is thus kept within the exposure-scale of a normal paper, but the lower values are well spaced out and the higher tones compressed. The eye derives a powerful impression of brilliance from the good separation of the lower and middle tones, so that even subjects of very great brightness-range can be rendered with good effect. This method needs a *compensating developer* which develops the lower tones fully while holding back the higher densities.

2

DEVELOPERS

How DO the developers in common use conform to these needs? Broadly they can be divided into the following six classes:

CLASS A. *High-contrast Developers*

The extremely hard-working developers used in process and technical work are unsuitable for general photography and can be left out of account. There are also a number of fast-working developers, intended mainly for press and commercial photography, which give fairly high contrast and density with short development times and are sometimes used by general photographers for negatives of low-contrast subjects. Proprietary developers labelled 'Contrast' or 'Press Contrast' can be assigned to this class. Like most standard developers they usually contain metol (a soft-working developing agent which gives good shadow detail at early stages of development) and hydroquinone, a hard-working agent which adds high contrast in the later stages. They differ from standard (class B) developers chiefly in their rapidity of action. Developers containing both pyrogallol and metol, as used by press and commercial photographers, also work rapidly. They tend to give high density and contrast, but have some compensating action. With the possible exception of pyro-metol, class A developers are scarcely suitable for all-round use.

CLASS B. *Standard MQ Developers*

The standard MQ (metol-hydroquinone) developers recommended by manufacturers of plates and films for most of their materials are less energetic and fast-working than those in class A and their action can be further slowed down by dilution. Clearly intended to reconcile conflicting needs and at the same time provide stock solutions which will keep well, they are good all-round developers, but are slighted by some photographers who habitually tackle subjects of strong contrast, in favour of others suitable for compensating development. Well-know examples are Ilford I.D.2, Johnson Universal MQ, and Kodak 61a. All three, as well as many other good developers of the same type, can be bought ready packed in either dry or solution form, or both.

CLASS C. *Soft-working Normal Developers*

Solutions of pyrogallol without metol and of metol without hydroquinone, suitably modified by other ingredients, make excellent soft-working developers, as do the para-aminophenol developers sold in concentrated form, as Ilford Certinal, Johnson Azol, and Kodak Kodinol. If development is prolonged they will give ample contrast without much fog. Thus their range of application is exceptionally wide and their claim to be considered all-round negative developers is as good as that of the developers in class B, or better, since they can be used for compensating as well as for normal development.

When mixed for use, pyrogallol oxidises and discolours fairly rapidly. The ingredients are therefore dissolved separately in two or three solutions which are kept in different bottles and mixed at the last

moment. Oxidation during development gives a brownish tinge to the image, raising its effective printing contrast and favouring the production of thin, delicately graded negatives without any excessive density in the high values and therefore without excessive grain, but capable of giving brilliant prints with a good separation of tones throughout the scale. If the solutions are stale or the mixture is left standing too long before development begins, there is some risk of random staining. Apart from this risk, which can be avoided by ordinary care, pyrogallol is perhaps the most useful and versatile of all developers. Weakening the developer by dilution with water gives a mild compensating effect which can be increased by altering the proportions in which the constituent solutions are mixed. The para-aminophenol developers are not capable of such strong compensating action, but in other respects are almost as versatile.

Azol, Certinal and Kodinol can all be bought ready for use in highly-concentrated solution form; they are of all developers the most suitable for intermittent users, as the stock solutions keep almost indefinitely. Plain metol developers like Kodak D.165 are not quite so handy, for they are not usually sold ready-packed and must be made up at home from bulk chemicals. The pyrogallol developers given in appendix C must also be mixed by the user, but ready-packed alternatives are available. Examples are Kodak D.177 Pyro-Soda Developer Powder and Kodak Developer Powders (Pyro-Soda) for Kodak Roll-Film Tanks.

CLASS D. *Ordinary Fine-grain Developers*

The ordinary fine-grain developers Ilford I.D.11 and Kodak D.76 (with many similar proprietary

developers) are the fine-grain equivalents of the standard (class B) developers. With films of inherently fine grain like Ilford Pan F they give a sufficiently fine grain for all practical purposes; with faster films the grain is only moderately fine. Contrast tends to be fairly high with the slower films; for the best results the development-times recommended by the makers should not be exceeded. Prolonged development in any solution containing hydroquinone is apt to give disconcertingly high contrast and considerable density in the upper values. Metol without hydroquinone makes a softer-working fine-grain developer which gives a rather finer grain at normal development-times and can also be used for prolonged development of negatives from subjects of low contrast. The plain metol fine-grain developer given in appendix C (Kodak D.23) is not sold ready-packed, as are D.76 and I.D.11, but as it contains only two ingredients it is easily made up. It is suitable for all-round use as well as for miniature negatives. In common with other class D developers it has a slight compensating action.

CLASS E. *Developers for Very Fine Grain*

There are many fine-grain developers which will give a very much finer grain than those in class D, but they demand that the negative shall have had about 50 per cent more than the normal exposure. Examples are Ilford I.D.48, Johnson Meritol-Metol, and Kodak DK.20. Kodak Microdol is also widely recommended. All appear to have some compensating action, and all those mentioned can be bought ready-packed.

CLASS F. *Developers for Still Finer Grain*

A number of developers which will give a phenomenally fine grain have been devised at various times, but their use with modern films is not always advisable. It is possible to have too fine a grain and thus impair the sharpness of the image. Moreover, attempts to get an exceedingly fine grain may produce negatives of such low contrast that they will not print well on any standard paper. It follows that a developer designed to give an exceptionally fine grain may be occasionally useful when subjects of excessive contrast have to be attempted. The Johnson Meritol Superfine Grain Developer (without metol) is satisfactory. For the best results give the negative about three times the normal exposure and develop for not longer than the times recommended in the leaflet supplied by the manufacturer. A class F developer which has been strongly recommended is Kodak D.25; it has the advantage of working well at relatively high temperatures. It should therefore be a valuable alternative to the more generally useful class E developers in the tropics or in exceptionally hot weather. It is a modification of the D.23 formula and is quite easily made up.

In the foregoing brief classification it has not been possible to mention specifically more than a tiny fraction of the many published formulas and proprietary developers. Nevertheless the number which cannot be speedily assigned to one or other of the classes listed is infinitesimal. The reader who studies this classification and also reads appendix C should have no difficulty in deciding what developer he needs for his particular purposes.

3

METHODS OF DEVELOPMENT

1. Dish Development of Plates and Sheet Films

PLATES and sheet films can be processed either one at a time in an open dish, or several at once in a closed tank. The first is a simple and efficient method which involves little outlay. The requirements are three dishes of the appropriate size; a larger vessel for washing; a graduated measure; a clock or watch, preferably with a dial visible in the dark; and a thermometer. For either method the operator will need a supply of developer, a bottle of acetic acid (glacial 98 to 100 per cent) and a quantity of fixer. Amfix Ultra-rapid Fixer with Special Hardener (May and Baker, Ltd.) is recommended for its convenience and efficiency. All these things can be bought from any photographic dealer.

A permanent darkroom is not necessary. If the work is done after sunset an ordinary well-curtained room will do, but chinks must be stopped up so that the work-place remains invisible even when eyes are accustomed to the darkness. In daylight an efficient blackout is essential and should include a light-trapped ventilator.

For dish development proceed as follows.

Having darkened the room and turned on the lights, prepare three dishes. The first dish should contain the developer, prepared according to the instructions given with the formula or by the maker, the second 1½ per cent solution of acetic acid (½ of a fluid ounce of acid to 16 ounces of water) and the

third the prepared fixer. A 5×4-inch plate can be developed in as little as 2 ounces of solution, but 5 ounces are better. The temperature of the developer, and preferably that of the stop-bath and fixer as well, should be adjusted to 65 degrees Fahrenheit unless the formula specifies some other temperature. This is easily done with baths made by diluting stock solutions if supplies of warm and cold water are available. Developers used at full strength and the fixer may have to be warmed or cooled by standing the bottles in water for some minutes. In hot weather it may be necessary to develop at a higher temperature and reduce the development-time accordingly, but if possible do not exceed 70 degrees Fahrenheit unless the developer is one specially designed to work most efficiently at high temperatures.

The next step is to work out the development time. The standard time for a given plate or film can be found from the instructions given with the formula or from the leaflet supplied by the maker. If only a range of times is given, a reasonable assumption is that the shortest time is for slow emulsions (which develop fast) and the longest for fast emulsions (which usually develop slowly). Exceptions are usually quite clearly indicated by the leaflet supplied with the box of films or plates.

The standard time for the plate or film is not necessarily the appropriate time in a given case. Both the nature of the subject and the characteristics of the equipment which will be used to make the print must be taken into account. To reduce confusion to a minimum, begin with a negative of a subject which *for you* is of average contrast and give the standard time. If the result is satisfactory, then that is *your*

standard time for *your* average subject. If, on the other hand, the negative is too contrasty or too flat, give shorter or longer times to subsequent negatives of similar subjects until the right density and contrast are achieved. Having arrived at a standard time for *your* average subject, you are in a position to make allowances for other subjects, giving shorter development times for those of higher contrast and longer times for those of low contrast. The object in every case is to obtain a negative which will print well, with *your* equipment, on a normal (No. 2) paper. If that object is not quite achieved, the error can be made good by printing on a soft (No. 1) or hard (No. 3) paper. But if you do not aim at the centre of the target in the first place you will have no margin for error, and a slight miscalculation may land you with negatives unsuitable for any of the three grades. Do not, therefore, pay heed to advisers who may tell you that there is no need to bother about the contrast of your negatives because the various grades of printing paper will bridge over any errors. It is true that still softer and harder grades (Nos. 0 and 4) of some papers are made to cater for extreme cases, but they are not always to be had, and, in any case, few dealers stock them. The principle of aiming at the centre of the target is always sound, and the reader who seeks consistent results is strongly advised to frame his methods accordingly.

For the moment we assume that the subject is of average contrast from the reader's standpoint and that normal or standard development is to be given. The variations appropriate for special subjects will be considered later.

Having arranged the dishes, noted their position

carefully and put the clock in a conspicuous place, take up the holder containing the plate or film to be developed, and turn out the lights. Orthochromatic films can be developed by the light of a ruby safelight, and panchromatic films by that of a special panchromatic safelight which gives a very dim illumination. If the clock-face is not visible in the dark a safelight will be necessary; otherwise it is much better to work in the dark. There should be no difficulty in doing so if the dishes are always put in the same places.

Now remove the plate or film from the holder and put it in the developing dish, emulsion side upwards. Hold it by the edges. A plate will sink at once to the bottom of the dish, but films are inclined to float and must be pressed down with a thumb and finger at each corner. Note the time. Rock the dish continuously until the time of development has expired, then lift it out. Ever if there is enough light to see the image, do not be influenced by its appearance; go solely by time. A plate can again be handled by the edges, but a film is more easily lifted by one corner. Put it in the stop-bath, rock the dish for about 30 seconds, then transfer it to the fixer. With films the same precaution against floating must be observed in the stop-bath and fixer as in the developer. If Amfix is used, the lights can be turned on after about a minute, during which time the dish must be continuously rocked. The negative should be left in Amfix for another minute or two with intermittent rocking and then transferred to the washing vessel, which should contain cold water, preferably at about 60 degrees Fahrenheit. It can be inspected by bright light at any time after the original minute in the ultra-rapid fixer, but nevertheless fixing is not complete

until it has been washed. If the washing is not done properly the image will not be permanent.

Efficient washing calls for either six immersions in fresh water, each lasting for 5 minutes, or 30 minutes in running water. Contrary to the usual belief, the first method is the better unless the running water can be led effectively to the bottom of the vessel and allowed to run out at the top. The harmful chemicals are removed by soaking, not by the pressure of running water, which performs no useful function except that of emptying and refilling the dish.

A single film or plate can be washed in the kind of dish used for developing, so long as it holds *at least* 5 fluid ounces of water for each 20 square inches of emulsion surface, but if several are developed successively it is not practicable to lay them one on top of another and wash them all together in that position. Apart from the risk of scratches, the washing would not be efficient. They must either be laid in a much larger dish (in which they can be allowed to accumulate until the whole batch is ready) or suspended vertically in a tank. The daylight developing tanks made to hold four or six films or plates make convenient washing vessels. As a rule films have to be inserted in special hangers, an operation which must be done with some care when they are wet to avoid scratching them.

When washed, the negatives must be put to dry in a place as free from dust as possible but not deprived of air. Specially heated and ventilated drying-cabinets can be bought (although their cost is not justified unless a great deal of work is done), but otherwise heat should not be used to hasten drying, which normally takes several hours. Plates should be stood

on end, preferably in one of the racks sold for the purpose, and films hung up by one corner (not left in their hangers). Some photographers wipe their negatives back and front with a rubber sponge, wash-leather or damp cotton-wool before putting them to dry. The practice promotes even drying and removes particles of grit or sediment which might dry on the emulsion, but also tends to cause scratches. On balance it seems inadvisable, unless the water used for washing is exceptionally gritty. Drying can also be hastened by giving the negatives a final rinse in water containing a few drops of wetting agent.

So much for subjects of average contrast. If the subject is of low contrast the negative must be developed longer, or, in other words, to a higher gamma, in order to achieve the same range of densities in the negative and allow the print to be made on the same grade of paper. How much longer depends on the extent to which the subject departs from average contrast. As it is seldom practicable to measure the contrast of the subject with an ordinary meter the reader must be prepared to experiment, relying on the range of alternative printing papers to bridge small errors. The nature of the developer is also an important factor. Thirty seconds longer than usual in a vigorous MQ developer may make a big difference in contrast, but scarcely any in one whose action is more gentle. In most class B and class C developers one quarter or one third more than the usual time will give an appreciable and useful increase in gamma, and the same is true of most of the fine-grain developers in classes D and E; remember, however, that longer development practically always means coarser grain. When the subject is of exceptionally low contrast we

may aim at the highest contrast of which the emulsion and developer are capable, or practical gamma infinity. In that case, as much as twice the usual time of development, or even more, may be desirable. Inherently soft, high-speed emulsions may need as much as sixty minutes in a soft-working fine-grain developer like D.23 before total development is achieved. When long development times must be given with the film or plate in a dish, the dish should be covered with a piece of cardboard to avoid any risk of fogging by stray light. But such long times for dish development are seldom convenient and it is generally better to use a tank.

Conversely, if the subject is of high contrast a means must be found of keeping the density-range of the negative within the compass of the printing paper. In moderate cases the situation can be met by using any ordinary developer and reducing the time of development by one quarter or one third. The negative should have been fully exposed or detail in the shadows may be lacking. A wise precaution, and a necessity in severe cases, is to use a soft-working developer. Fine-grain developers are suitable and are all the better for having a slight compensating action. With some developers the time may be cut by as much as one half if exposure has been full. But a safer rule is to assume that if the subject contrast is so high that a reduction of one third in the development time is not enough, special methods must be adopted.

Every photographer who works out of doors is familiar with cases which call for such special methods. Perhaps the scene includes brilliant reflections from water or sunlit fabric as well as large areas of fairly

deep shadow; or a tree partly in shadow stands out against a sunlit landscape, and we want to show the texture of the shadowed bark without losing detail in the background. By using a soft-working developer and reducing the time of development we can get negatives from such subjects which will print on No. 1 or No. 2 papers, but the results are often disappointing. There is detail of a sort in all parts of the image, but the shadow-tones are not well spaced out and the general effect is harsh rather than brilliant, or soft rather than subtle, according to our choice of printing paper. We may be able to get a better print by eschewing compromise and printing so as to favour one end of the scale at the expense of the other, but the result is still not what we expected. To render such subjects properly we need a developer with a strong compensating action, which will develop the lower and middle tones fully and compress the upper end of the scale. A print on normal paper will then show brilliant gradation throughout three quarters of the scale and give a soft, glowing appearance to the upper values. As a rule this is exactly what we want.

Most developers intended to give very fine grain have a more or less marked compensating action, but when considerable depression of the high values is wanted many photographers prefer a dilute pyro-soda developer, preferably with its energy reduced by a simple modification of the ingredients. So used, a pyro-soda will itself give a reasonably fine grain and can therefore be used for miniature negatives intended for enlargement up to about seven diameters. Instructions are given in appendix C.

2. Tank Development of Plates and Sheet Films

When there are several plates or films to develop and especially when development times are long—as is usually the case with fine-grain and compensating developers—a tank is useful. Commercial firms use large open tanks holding several gallons of solution. For use at home small 'daylight' tanks with a light-tight lid are best. One of their advantages is that once the lid is on the rest can be done in daylight or bright artificial light.

Most daylight tanks provide light-trapped entrances and spouts so that the developer can be poured in after the plates or films have been put into the dry tank in the dark. This is a useful arrangement when no darkroom is available and loading has to be done in the cramped space of a cupboard or wardrobe. But if conditions permit, a better practice is to start by filling the tank, then turn off the lights, put in the plates or films, put on the lid and turn on the lights. When the time is up, the developer can be poured away and the stop-bath poured in without turning out the lights or removing the lid. The same applies to the fixer. When the last has done its work, the lid can be removed and washing done in the tank. This ensures a clean tank as well as clean films, but washing must be thorough.

As the plates or films stand vertically in the tank, the by-products of development do not accumulate so readily in the emulsion, and the continuous rocking necessary with dish development is not needed. Even so, the solution must not be left to stagnate. Intermittent but systematic agitation is essential. A good plan if the development time exceeds 10 minutes is

to shake the tank gently for the first minute, then for 30 seconds at the end of the second minute and thereafter for 30 seconds at the end of each alternate minute. For shorter times, shake gently for the first 30 seconds, then for 15 seconds at the end of each minute. Check the temperature at half-time by inserting a thermometer in the place provided, and adjust the time if necessary. In cold weather the temperature is almost certain to fall a little in the course of development, and in hot weather it may rise.

Daylight tanks are usually made to hold four or six plates or sheet films, and unless much of the convenience of tank development is to be sacrificed all must be given the same development. Negatives which need more or less than the standard time should therefore be arranged in separate batches.

3. Development of Roll Films and 35-millimetre Film

Roll films and strips of 35-millimetre film must be developed in a tank. Other methods have been practised, but they are seldom satisfactory. Daylight tanks to take any of the standard sizes can be bought, and some are adjustable for a range of sizes from the smallest up to the largest in everyday use. As with tanks for plates and sheet films, loading must be done in the dark, although some tanks for 35-millimetre film allow of daylight loading direct from the film-cartridges (cassettes). Again, the developer should be put in first if conditions permit. There is then less risk of frothing, air bubbles and uneven development. Agitation is usually done not by shaking the whole tank but by turning a spindle which rotates the spool on which the film is wound.

The only difficult operation in the tank development of roll films and 35-millimetre films is the loading. Roll films usually cause the greater difficulty, as they are thinner and the paper backing may be an encumbrance. The film must be handled by the edges only and not allowed to kink. The secrets of success are to study the instructions given with the tank; to practise loading first in daylight (with a spoiled film), then with the eyes shut, and finally in the dark; and to work methodically, without haste or panic. There is no need to hurry, for if the room is dark it does not matter how long the loading takes; if the room is not dark the film will probably be spoiled anyway. A good tip if one gets into difficulties when working in the dark is to pause and try to form a mental picture of the things one is handling. This simple procedure clears the mind, steadies the nerves and disciplines the muscles, so that when work is resumed the materials seem less refractory. An elementary precaution is to make sure before turning off the lights and unwrapping the film that everything likely to be wanted is close at hand, including a pair of scissors for clipping off the leading corners of the film and severing the attachment of one end of a roll film to its paper backing or of a 35-millimetre film to its spool. Further directions need not be given here, as the exact procedure depends on the design of the tank and is sure to be laid down in the instructions supplied with it.

The principles of tank development are the same whether an ordinary or a fine-grain developer is used, but if fine grain is wanted special care must be taken to keep the developer, the stop-bath and the fixer at the same temperature. The film should not be removed from the developing-spool until washing is

complete, and the method of removal recommended by the maker should be carefully followed, or the film may jam. Roll films to be developed in a solution containing Meritol should first be soaked in plain water (at the same temperature as the developer) for 3 minutes in order to remove the coloured anti-halation backing, which might otherwise impede development. The spool should be agitated during this preliminary soak; if the water is strongly discoloured when it leaves the tank a second brief rinse is a wise precaution. This procedure of course makes it impossible to observe the rule of putting the developer into the tank before inserting the loaded spool, but as the preliminary wetting should ensure even development the same end is served.

Obviously, with roll films and lengths of 35-millimetre film variations in the time of development to make up for differences in contrast between one subject and another are impossible: all the negatives on the roll or strip must be developed for the same time. The user of these films should therefore aim at a degree of development which will enable him to print negatives from subjects of the kind which he regards as 'average' on normal (No. 2) paper. Softer or harder papers can then be used for negatives from subjects of more or less than the average contrast. This procedure usually takes care of subjects of normal to fairly high contrast; those of low contrast or of excessively high contrast are ruled out unless a whole roll or strip of film is dedicated to them. A further difficulty which confronts the user of a miniature camera is that the prolonged development necessary to give a negative of adequate printing contrast from a low-contrast subject usually means coarse grain.

Something can be done, however, by choosing the film to suit the subject. A relatively slow film like Pan F developed for the standard time in I.D.11 or for a little longer than usual in D.23 should enable the user to get vigorous prints of fairly low-contrast subjects on a No. 3 paper without excessive grain, while the faster films developed in class E and class F developers are capable of dealing with subjects of high contrast. But in practice these chops and changes are not always convenient. A simpler and generally more satisfactory arrangement is to use the miniature camera only for subjects of normal to fairly high contrast and switch to a plate camera when subjects which require special treatment must be tackled. Nevertheless it is fair to add that for many people the very difficulty of tackling such subjects with a tiny camera is a legitimate attraction. In the hands of an expert a good miniature like the Leica or the Rolleiflex is capable of extraordinary feats.

When washed, roll films and strips of 35-millimetre film should be hung up by one end to dry and a weight should be attached to the other end to keep them steady and prevent excessive curling. Wiping to hasten drying is not advisable. When dry, roll films should be cut into separate frames and 35-millimetre films into strips of four or six frames. Lacking a coat of gelatine, the back of a 35-millimetre film often carries drop-shaped drying marks which can be removed by putting the strip face downwards on a clean surface and polishing the back first with a damp, soft rag and afterwards with a similar rag which is quite dry. This treatment must not be applied to the emulsion side or to roll or sheet films; it can be applied to plates, but is seldom necessary.

4

JUDGING THE NEGATIVE

WHEN IT is dry (and not before) the negative can be judged for quality.

Apart from defects of density and contrast, the commonest faults are clear spots caused either by specks of dust or by airbells which have clung to the emulsion during development. Unless due to defects in manufacture, the first can be minimised by brushing the insides of cameras and plate-holders with a camel-hair brush before loading. The second are sometimes due to using water straight from a high-pressure main. The trouble can be cured by making up solutions with boiled water or, at any rate, with water that has been well stirred. Black specks are usually due to undissolved particles of developing agent in the developer or floating in the air. The remedy is to handle chemicals with care and filter solutions before using them if there is any doubt about their clarity. Random staining, uneven development and mottling are faults easily avoided by using fresh solutions and giving proper agitation.

Faults of density (due to incorrect exposure) can be diagnosed by the appearance of the negative. Faults of contrast (due to incorrect development) are more easily detected by making a trial print. Because of their brownish colour negatives developed in pyro-gallol or in developers intended to give very fine grain usually look lower in contrast than they prove to be; conversely, negatives developed in fresh solutions of metol or amidol have a fine blue-black colour which gives them a deceptively vigorous appearance.

The various combinations of correct or incorrect exposure and development can be diagnosed from the following symptoms:

1. Under-exposure and Correct Development

The deepest shadows are clear glass or celluloid, the lower middle tones weak and not well separated, and even the highest values far from dense. No remedy. A print with blocked-up shadows must be accepted. A hard or normal paper may give a fair result if the lower tones do not form a vital part of the picture.

2. Under-exposure and Under-development

Still worse. The whole negative looks thin and ghostly. Intensification (see section 5 of this chapter) may improve the negative a little, but not much. Try a hard paper.

3. Under-exposure and Over-development

The deepest shadows are clear glass or celluloid, the middle tones are crisp and vigorous, the highest values fairly dense. Thus the contrast between the lowest and highest values is high. A soft paper should give a tolerable print, but the shadows are sure to block up and the lower middle tones will not be well separated. No remedy.

4. *Correct Exposure and Correct Development*

Detail is visible in all parts of the negative when it is held up to the light. (Small areas of clear glass or celluloid are permissible if they are to be rendered dead black in the print.) The negative prints well on a normal paper (or on a soft paper if the subject-contrast was very high).

5. Correct Exposure and Under-development

Detail is visible in all parts of the negative, but the highest values lack density and a print on normal paper looks flat and muddy. Try a harder paper, or a more vigorous paper-developer, or both. If all else fails, intensify. But intensification nearly always means coarse grain and is seldom suitable for miniature negatives.

6. Correct Exposure and Over-development

Detail is visible in all parts of the negative, but the highest values are excessively dense, and even a soft paper gives a harsh print. Try a low-contrast print-developer. If that fails, reduce (see section 5 of this chapter).

7. Over-exposure and Correct Development

If the negative has been very generously exposed and then developed for the time which would have been correct for a normally-exposed negative, there will be detail in all parts of the image, but contrast will be lacking, the overall density will be high, and the detail in the highest values may be difficult to see unless the negative is held up to a strong light. A normal paper will probably give rather a soft print and a hard paper quite a good one, but in both cases the exposure times will be long. Reduction may improve the negative considerably.

8. Over-exposure and Under-development

An over-exposed and under-developed negative shows detail in all parts of the image, and the overall density is moderate, but the contrast may be so low

that even a hard paper gives only a soft, muddy print. It needs intensification, but should first be reduced slightly.

9. *Over-exposure and Over-development*

A negative which has been over-exposed and then developed for longer than usual is bound to be dense and may look flat, but if it is held up to a very strong light detail will probably be visible in all parts of the image. With a sufficiently long printing-exposure it may give a perfect print; on the other hand, the highest values may be so dense as to be virtually unprintable. In the second case the negative should be reduced.

5

INTENSIFICATION AND REDUCTION

As SUGGESTED in the preceding section, something can be done to improve the character of an image which is faulty because of incorrect development or excessive exposure. Nothing can be done for one which has been seriously under-exposed, for no after-treatment will add detail not already present.

Negatives intended for after-treatment should have been well fixed and washed. They should be thoroughly soaked in water before the treatment is begun.

Intensification is most easily done by bleaching the image in a solution which changes the silver into a substance that includes a compound of chromium. Re-development in a standard MQ developer then gives an image which is both denser and of higher

contrast than the original silver image. The ready-made chromium intensifiers sold by photographic dealers are quite satisfactory, and the instructions supplied with the product should be followed. Other intensifiers are not so reliable and are not recommended.

Reduction implies the removal of some of the metallic silver which forms the image. If too much is removed the detail in the shadows will be lost. The following solutions should be made up with warm water and allowed to cool:

Solution A

Sodium thiosulphate (hypo)	100.0 gms. or 700 grs.
Water to make	1,000 c.c. or 16 fl. oz.

Solution B

Potassium ferricyanide	7.5 gms. or 52 grs.
Water to make	1,000 c.c. or 16 fl. oz.

Soak the negative for about 2 minutes in a little of solution A with constant agitation, then pour off the solution and add to it a few drops of solution B. For slight reduction with no appreciable change in contrast, use enough of B to make the mixture pale yellow. For stronger reduction with some effective *increase* in contrast, use enough to give it an orange colour. Pour the mixture on to the negative and agitate continuously until the right degree of reduction is obtained, but in any case for not more than 5 minutes. Then wash the negative at once in running water. Discard the mixed solution after use. If insufficient reduction is obtained in 5 minutes, repeat the treatment with fresh solution after the negative has been washed. Finally wash the negative for at least 10

minutes in running water and put it to dry in the ordinary way. A flat negative which has been thus reduced to add contrast can be afterwards intensified with the chromium intensifier. Conversely, a dense, over-developed negative will not be lowered in contrast by reduction; indeed, its contrast is more likely to be increased. Nevertheless, its effective printing quality will probably be improved because its darkest parts will no longer be too dense for the printing light to penetrate.

There are many other reducers, but this one (called Howard Farmer's, after its inventor) is the simplest and most reliable.

An alternative method of reduction, chiefly useful as a means of improving coarse grain due to over-exposure and over-development, is to bleach the image and re-develop it in a soft-working developer designed to give moderate density and fine grain. The solutions prescribed by A. Seyewetz a generation ago were:

Solution A (bleacher)	
Potassium ferricyanide	100.0 gms. or 700 grs.
Water to make	1,000 c.c. or 16 fl. oz.
Solution B (re-developer)	
Paraphenylene-diamine	10.0 gms. or 70 grs.
Sodium sulphite, anhydrous	60.0 gms. or 420 grs.
Water to make	1,000 c.c. or 16 fl. oz.

After it has been bleached in solution A the negative is rinsed for 10 minutes in running water and then re-developed by weak daylight or strong artificial light in solution B. As a substitute for solution B a plain Meritol developer with about half the usual

quantity of sodium sulphite and diluted to one third its normal strength seems to work quite well. The treatment improves the grain considerably but does not restore any detail destroyed by the coarseness of the grain in the original image. Development should be continued until all parts of the image are plainly visible. The negative should then be fixed and afterwards washed and dried in the usual way.

Both intensification and reduction should be regarded as emergency measures and should not be undertaken lightly. If reasonable care is taken to expose and develop correctly they should seldom be necessary.

6

SPOTTING AND RETOUCHING

PROFESSIONAL and commercial photographers who use large negatives often work manually on the image, scraping out unwanted parts with a knife and adding detail elsewhere with a brush or pencil. Unless the retoucher is highly skilled the value of these embellishments is doubtful. His handiwork is often visible in the print, so that the artistic principle of fidelity to the medium is sacrificed. A photograph is a picture made by a machine—of course directed by a human sensibility—and ought not to look like a monochrome painting or a drawing. The reader is advised to limit his efforts in this direction to spotting and (in rare cases) local reduction. Even these are impracticable with miniature negatives, so that blemishes must either be avoided altogether or corrected in the print.

Spotting is the filling in of clear spots (which would

otherwise print black) with opaque medium or transparent dye applied with a fine brush (No. 0 is best). It is not absolutely essential that the spot should be painted to match the adjacent parts of the negative. If it is made darker it will print lighter and the light patch can easily be darkened to match the rest of the print; if it remains lighter it will print as a dark spot and its removal from the print will be more difficult. As a rule the biggest problem is to hold the negative in a position which enables the photographer to work on it while viewing it by transmitted light. If much work is done, a retouching desk should be bought. A darkroom safelight with its usual screen replaced by a sheet of opal or ground glass makes a tolerable substitute. The negative can be put with its back in contact with the glass and held with one hand by the edges while the other hand holds the brush. If the light is turned on it will be strongly illuminated and the spot to be retouched will show up well. It should not be left there too long or the heat may damage it.

Local reduction is the removal of silver by chemical or mechanical means from parts of the negative which print too light. It should not be undertaken unless all attempts to get a harmonious effect by using soft paper and a soft-working print-developer have failed. To reduce chemically, soak the negative in water and lay it emulsion-side upwards in a white dish. Apply Farmer's reducer (the two solutions mixed) to the too-dense parts with a brush or a swab of cotton-wool. Afterwards rinse the negative thoroughly. If the solution is inclined to run into parts which are not to be reduced it can be thickened with glycerine. Alternatively, reduce the image mechanically by rubbing down with a rag or wash-leather soaked in alcohol or

in the proprietary Frictol. Drastic as it sounds, the treatment is quite effective with large negatives on glass plates. It should not be attempted with negatives which are to be enlarged more than about three diameters and is quite unsuitable for miniature negatives.

CHAPTER V

MAKING THE PRINT

I

PRINCIPLES

PRINTING is the simplest operation in photography and should be made as mechanical as possible. Beginners often do better than more experienced workers because they stick to the rules and do not try to influence the result by dubious manipulations or 'controls'. If negatives are correctly exposed and developed printing will be straightforward.

A perfect print shows clearly everything that is in the negative and is of pleasing surface and good colour. Clarity is obtained by choosing a paper of suitable texture and of the right contrast-grade to suit the negative, by correct exposure and development and by using suitable equipment. To show everything that is in the negative often remains an unattainable ideal, because of the inherent difference between a transparency and an image viewed by reflected light. The best possible result is again secured by choosing the right paper, exposing it correctly and developing it fully. A pleasing surface demands not only a wise choice of paper but correct drying. A good image colour is obtained once more by choosing the right paper, but also by choosing the developer to suit it and by developing the image fully. Except in special cases the image should be composed of neutral blacks and greys, inclining towards a blueish rather than a

brownish cast. Unless deliberately sought for some special purpose, a rusty or greenish tinge is always a mark of poor quality.

2

PRINTING PAPERS

PRINTING papers are made with a variety of surfaces and base textures. They are coated with a variety of emulsions to suit different purposes, and they are made in several contrast-grades in order that they may fit the density-range of a variety of negatives. The beginner is therefore faced at the start with a bewildering choice. However, the matter becomes quite simple if we consider these points one by one.

1. Surface Finish and Base Texture

For most purposes smooth, glossy papers are best, as they give the clearest image and have the highest brightness-range. Dull and rough surfaces are often pleasing in themselves, and because they remind us of high-quality drawing and writing papers, but they do not make for such good photographic reproduction. Nevertheless for large prints (15 × 12 inches upwards) grained half-matt and fine-grained lustre papers provide a useful compromise. Their slight shimmer breaks up large areas of even tone which might otherwise look flat, and helps to conceal coarse grain or imperfect definition. Fully matt papers are seldom satisfactory, even when the base is smooth, because of their low brightness-range and the consequent marked loss of contrast as they dry. With a rough base they recall the unhappy aberrations of the pictorial school of forty years ago, which regarded poor definition,

coarse texture, inferior gradation and a muddy appearance as the hall-marks of aesthetic excellence.

Except when they are to be mechanically glazed, double-weight papers are better than those of single weight, as they are less easily damaged in processing and curl less on drying. Single-weight papers are quite suitable for small contact prints.

To sum up, the reader is advised to choose smooth glossy papers (double or single weight) in sizes up to 12 × 10 inches, and those of the kind usually called 'grained half-matt', 'fine-grained lustre', or 'satin' (double weight) in larger sizes. A supply of each of the three main contrast-grades (Nos. 1, 2 and 3) should be bought together. A point to note is that whatever the surface the 'finish' actually achieved depends to some extent on the method of drying.

2. *Type of Emulsion*

Contact prints can be made on practically any type of printing paper, but for convenience are usually made on those called 'contact' or 'gaslight'. These papers are also called 'chloride' papers because silver chloride is the chief active ingredient of the emulsion. They are relatively slow (an advantage, as printing times might otherwise be unmanageably short) and can therefore be safely handled and processed without a darkroom and by the light of an ordinary electric lamp, so long as it is not too powerful and its rays are not allowed to fall directly on to the paper except during exposure. They readily give an image of the approved blue-black colour, and as development usually takes less than a minute processing is quick. They cannot be used for enlargements unless the

photographer commands an exceptionally powerful source of light.

Enlargements are usually made on bromide papers, so called because silver bromide is the chief active ingredient. Bromide papers are much faster than chloride and (with normal developers) the image does not develop quite so quickly. With careful processing they give images of a good neutral colour. They can be used also for contact printing and are the best all-round papers. They must be handled and processed by the light of a safelight of the colour specified by the manufacturer—usually deep orange, brown or olive-green.

Chlorobromide papers (coated with an emulsion which contains both ingredients in varying proportions) are also widely used. They are made in both slow and fast varieties. The slow chlorobromide papers are used mainly by professional portrait photographers for making contact proofs and are not recommended for general work. The fast kinds are preferred by some workers to bromide papers, partly because they are said to give a more subtle rendering of the middle and higher values, partly because they yield passable results even when incorrectly exposed and not fully developed. When normally processed they give images of a warm black colour inclining slightly towards brown or black. The colour can be modified by 'toning', or special developers can be used to produce a definitely brown image. It is fair to add that tastes differ and that, while the off-black colour of a normally-developed chlorobromide paper may be offensive to the purist, some people prefer it to that given by a chloride or bromide paper.

A cream or ivory base is sometimes agreeable when the image is to be developed to a brown colour. Otherwise, and always with chloride and bromide papers, a white base should be chosen.

3

EQUIPMENT

THE BASIC equipment for printing comprises three dishes of the appropriate size, a larger dish for washing, a graduated measure and a thermometer. A clock or watch with a second hand is desirable for timing exposures, but can be replaced by a metronome or by a device which can be set to switch the lamp off at the end of a given time.

The simplest way of making a contact print is to put a piece of paper on a table, emulsion side upward, put the negative on it, emulsion to emulsion, and lay a sheet of heavy plate-glass over the top so that the two are pressed firmly into contact. A lamp held or suspended a foot or so above the table is then switched on for a time (determined by test) which just suffices to print through the heaviest densities of the negative. The paper is then developed and fixed like a negative.

In practice it is usual to replace the sheet of plate-glass by a printing-frame. First the negative and then the paper are put into the frame (again emulsion to emulsion); they are held firmly together by the back, which is coated with felt and kept in place by strong springs. Frames can be bought in various sizes. It is also possible to buy printing-machines, which incorporate a lamp, often automatically switched on by

closing the pressure-plate which holds the paper and the negative in contact.

If white margins are wanted, the edges of the negative should be masked off with strips of black paper or ready-cut celluloid masks. Put the mask into the frame before the negative; if it is put in afterwards it may impair the sharpness of the print by holding the negative and the paper apart.

To make prints by projection, a projector called an enlarger is required. The word is a misnomer, for an enlarger provided with a sufficiently long extension can be used equally well for making prints about the same size as the negative or smaller.

Broadly, enlargers can be divided into those which project the image horizontally on to a wall or easel, and those which project it vertically on to a baseboard or low table. Other things being equal, the greater the distance between the lens and the paper the bigger the enlargement; an advantage of the horizontal pattern, therefore, is that the degree of enlargement possible is limited only by the size of the room. On the other hand, vertical enlargers are generally more compact, and the arrangement and focussing of the image become easier when it is projected on to a baseboard or table immediately under the operator's eye. Except for giant enlargements, therefore, a vertical enlarger is usually more convenient. As a rule, the biggest print that can be made with a vertical enlarger in the ordinary position measures something between 10 × 8 inches and 20 × 16 inches. The projection-head can usually be turned round or swung into the horizontal plane so that the image can be projected on to the floor or a wall when an exceptionally large print is wanted.

Other points of difference are the method of illumination, the method of focussing, and the lens. They are sufficiently important to be considered one by one.

1. The Method of Illumination

A projection-print is made by shining a light through the negative on to the printing paper. The designer's problem is to arrange matters so that roughly the same amount of light reaches all parts of the negative, the natural tendency if the lamp is put fairly near it being for the centre to obtain far more than the corners. This could be cured by putting the lamp a long way off, but then the image would be dim and the exposure would have to be inordinately long.

A solution which works well, although it wastes a good deal of light, is to use a relatively large and powerful source of light (a big electric-light bulb, for example) a fair distance from the negative and separated from it by one or two sheets of flashed opal glass which help to equalise or diffuse the light. This is a good arrangement for negatives of about quarter-plate size upwards, although for those larger than 5 × 4 inches one bulb may not be enough.

Another method is to use a very small source of light and a condenser which brings its rays to a focus inside the enlarging lens, after they have passed through the negative. If the condenser is bigger than the negative this arrangement ensures even illumination, but it also has the less happy effect of increasing the effective contrast of the negative and exaggerating any flaws.

A third method which represents a compromise between the first two is to use a relatively large and diffuse source of light such as a big opal bulb and a

condenser as well. This is the arrangement now almost universally adopted for small enlargers intended to take miniature negatives. It is also used for many enlargers designed to take 6 × 9-centimetre and even larger negatives, although others use purely diffuse illumination. As a rule, the combination of a diffuse source and a condenser (more often a pair of condensers) gives some increase in effective contrast.

If a condenser-enlarger is to be used with lenses of more than one focal length for enlarging from negatives of different sizes, there should be provision for changing the condensers or, at any rate, the distance between them and the lamp.

2. The Method of Focussing

With a given lens, the degree of enlargement is determined by the distance between the lens and the board which carries the printing paper. As a rule, the lamp-house, negative-carrier and lens are all moved bodily until an image of about the right size is obtained; it must then be sharply focussed by moving the lens further from or nearer to the negative. This again changes the size of the image slightly (or considerably if it was very much out of focus in the first place). Some expensive enlargers have a coupling arrangement which automatically keeps the image in sharp focus as the lamp-house moves up or down. More often, focussing has to be done manually and by inspection. Most enlargers intended to take negatives from quarter-plate upwards are fitted with bellows, and focussing is done by turning a milled or knurled wheel. If there is ample extension they can be used to make pictures smaller than the negative—an important point if lantern-slides are to be made from fairly

large negatives. In other cases, an additional extension-piece can be fitted. Smaller enlargers are usually focussed (like reflex and roll-film cameras) by rotating the lens in a helical mount. For obvious reasons the need to make reduced positives from miniature negatives seldom arises and so there is little need for a long extension.

3. The Lens

As a rule the price of an enlarger does not include the lens, which must be ordered separately. A good camera-lens (preferably a symmetrical anastigmat) can be used, but an enlarging or process lens specially corrected to give its best performance at short ranges is better. Coated lenses are best. The lens must cover the negative perfectly and give even illumination to the corners of the image. Consequently its focal length should not be less than the diagonal of the negative. If it is much more a long 'throw' will be necessary to get a large enough image on the paper. Hence if a single enlarger is to be used for enlarging from negatives of different sizes a choice of lenses all fitting the same flange may be advisable.

A good enlarging or process lens should cover the negative sharply and evenly at its full aperture. A camera-lens—even though it covers the negative perfectly at its full aperture when used on the camera —may need to be stopped down considerably when used on the enlarger. Hence exposures may be rather long unless the source of light is unusually powerful.

In the light of the foregoing, the following equipment (besides the developing dishes and other essential items already mentioned) is recommended:

For contact printing. A printing-frame of the appropriate size and two or three ready-cut masks. The thin sheet of glass supplied with the frame can be removed when glass negatives are used, but will be needed for film negatives. If it gets broken or scratched prepare a new one by washing the emulsion and anti-halation backing off a spoilt plate with hot water. No special lighting equipment is necessary. Use an ordinary electric-light bulb (preferably of the pearl or opal pattern) held or suspended a foot or two above the frame. In districts where electric current is not available, use a gas or oil lamp.

For projection-printing from 6 × 9*-centimetre, quarter-plate,* 9 × 12*-centimetre and* 5 × 4*-inch negatives.* A vertical enlarger employing diffuse light is as good as any. (The Adams Amateur Model is an example of such an enlarger and is equally suitable for all the sizes mentioned.) An opal or white-sprayed lamp (75-watt, 100-watt or 150-watt) is generally suitable, but the maker's recommendation should be studied. A 6½-inch enlarging lens will cover the largest of these negatives, but for big enlargements from the smaller sizes one of shorter focal length may be more convenient. If the cost of such a lens is too great, a second-hand symmetrical camera-lens such as a Zeiss Protar, Goerz Dagor or Ross Homocentric can be used instead, but may need stopping down. If electric current is not available it may be possible to use the bulb from a motor-car headlamp and run it from an accumulator. In that case an enlarger of the condenser pattern must be used and will probably need some modification. Consult a reliable photographic dealer or an electrician with a thorough knowledge of photography.

For projection-printing from miniature negatives. A vertical

enlarger fitted with a condenser or pair of condensers is best. Reliable examples are the Reid and Sigrist (for 35-millimetre negatives); the Envoy (35-millimetre and larger models); and the Kodak Precision, which takes all sizes of miniature negatives and also negatives up to 6 × 9 centimetres. There are many others. Use the lamp recommended by the maker and an enlarging lens of high quality. Again, if electric current is not available, a small bulb run from an accumulator may provide the answer, but the guidance of an expert should be sought.

The best enlargers (especially those made for miniature negatives) are expensive. If limited means restrict your choice, buy a simple but sturdily built enlarger and the best lens you can afford. Outlay on an elaborate enlarger is unwise if it means that a poor lens must be bought. So long as it is rigid and is fitted with a good lens, a moderately-priced enlarger will probably achieve just the same results as the most expensive, although it may not be quite so convenient or adaptable.

4

PRINT DEVELOPERS

AT ONE time contact prints were commonly made on 'printing-out papers'. The image became visible during exposure and could be inspected by lifting the hinged back of the frame. When the right density was achieved the paper was removed and the colour of the image modified by 'toning'. Afterwards the image was fixed, or, alternatively, a combined fixing and toning bath was used in the first place.

Printing-out papers still have their uses, but in this

book it is assumed that prints will be made on one or other of the development papers already described. With development papers, as with negatives, the image is invisible or latent until it has been developed; afterwards the paper must be fixed, washed and dried.

The chief difference between the development of prints and that of negatives is that with rare exceptions a print is always fully developed. Anything less than full or almost full development usually means poor colour. Hence an energetic, rapid-working developer is best. Whether it is soft-working or hard-working is of small importance so long as it develops rapidly and does not tend to produce fog. Rapid action decreases the risk of staining, and if slower development is wanted—as it sometimes is in special cases—care must be taken to use a particularly clean-working solution.

For contact (chloride) papers the standard MQ (contact) developers recommended by the paper manufacturers can scarcely be improved upon, and the instructions supplied with the paper should be followed. For bromide papers either the standard MQ developer recommended by the manufacturer or a good 'universal' MQ developer (such as Johnson Universal) is usually quite satisfactory and gives an image of a good neutral colour. Slightly modified MQ developers (such as Johnson Bromide Developer) sometimes give a greater tendency towards blue-black, which is often an advantage. Perhaps the best developers of all for bromide papers are those containing amidol, but they do not keep and must be mixed immediately before use. With amidol developers variations in the time of development are less likely to affect the colour, and so the density and contrast

of the image can be controlled to some extent by this means and by varying the dilution. Nevertheless it is wiser as a rule to stick to standard times and strengths. Occasionally a dilute amidol developer may be useful to achieve a kind of compensating effect. Prolonged development then gives good separation of the higher tones without blocking up the shadows, and the colour remains good.

The development of chlorobromide papers is something of a problem. Development in the standard MQ developers usually gives an off-black image which many people admire but which may not be judged satisfactory by the highest standards. Special developers such as Kodak D.166 and Johnson Chlorquinol can be used to give brown-black or brown images, but the exposure time and often the time of development must be increased. Alternatively, after the print has been developed, fixed and washed, the colour of the image can be changed by 'toning'. Unfortunately most toners designed to change the colour to a definite brown or sepia contain ingredients which have an unpleasant smell and emit vapours harmful to photographic materials. Among the toners which do not have this fault are the Kodak Selenium Toner (which can be bought ready-made or made up to Kodak Formula T.55). With most chlorobromide papers it gives a purplish-sepia colour. Very rich colours can be got by bleaching the image obtained by normal development and re-developing in a colour developer. Complete outfits for colour development (such as Johnson Colourform) can be bought, but the materials are fairly expensive. Once mixed they do not keep very well, so that the treatment is not economical unless a reasonably large number of prints can

be processed in one batch. By a simple method of selective bleaching they can be used to make prints in several colours. The treatment is not suitable for the production of realistic colour prints, but lends itself admirably to broad decorative effects.

5

PRACTICAL PRINTING

WHETHER a contact print or an enlargement is to be made, begin by preparing a dish of developer, a stop-bath and a fixing-bath, as for the dish development of negatives. The stop-bath can with advantage be stronger than that for negatives, but not more than about twice as strong. Use plenty of solution; unless the print is amply covered in all three baths it may be stained. Prepare the negative for printing by dusting it gently with a camel-hair brush. Put it into the frame or the carrier of the enlarger with its back towards the front of the frame or towards the source of light. Many enlargers for small negatives have glassless carriers in which film negatives are held flat by the condenser. In other cases films must be sandwiched between sheets of flawless glass. In enlarging, the clear margins *must* be masked off either by means of a device built into the enlarger or with masks of celluloid or paper. Strips of black paper can be pasted on to the borders of a sheet of glass for use with film negatives; similar strips can be pasted directly on to the backs of glass negatives and will not harm them if the paste or gum is kept clear of the emulsion side. In contact printing masking is not necessary unless white margins are wanted on the print.

In enlarging, the next step is to compose and focus the image on the baseboard. Put a sheet of white material—an old print turned upside down is best—in the position later to be occupied by the printing paper, and the image will show up clearly. After focussing, stop down the lens if experience has shown that it is necessary. Evenness of illumination can be checked by removing the negative after focussing and examining the patch of light thrown on to the paper. The paper used for focussing, and afterwards that used to make the print, can be either held in a frame or pinned to the baseboard by the corners. The first is necessary if white margins are wanted. Slight convergence of lines which should be parallel in the negative can be corrected by tilting the paper, but definition will suffer unless the lens is greatly stopped down and the vertical and horizontal proportions of the image may be falsified. A few enlargers enable the negative-carrier to be tilted for the same purpose.

The right contrast-grade of paper to suit the negative must now be chosen. A negative of normal contrast needs a normal paper, a hard, contrasty negative a soft paper, and a soft negative a hard paper. If in doubt, use a normal paper and make a test.

In any case a test must be made to determine the exposure. Use a strip of paper the full length of the print and about two inches wide; for small contact prints a whole sheet may be necessary. Put it in the printing-frame or on the baseboard in such a position that it takes in the most important parts of the picture, including areas of bright light and deep shadow. Expose for 5 seconds. Then cover one quarter of the strip with a book or a piece of card and again expose for 5 seconds. Cover one half and expose for 10 seconds.

Finally, cover three-quarters and expose for 20 seconds. The four quarters of the strip will now have had exposures of 5, 10, 20 and 40 seconds respectively. If experience has shown that the correct time of exposure is likely to be longer, the procedure can of course be varied so that the quarters are exposed for, say, 10, 20, 40 and 80 seconds. If possible, the illumination (governed by the intensity of the light, distance from the paper and, in enlarging, the stopping down of the lens) should be so arranged that exposures are somewhere between 5 and 60 seconds. Exposures shorter than 5 seconds are difficult to time, and small errors may have large effects; exposures much longer than 60 seconds may change the effective scale of the paper. But when big enlargements must be made from small negatives this advice cannot always be followed, and exposures up to 3 or 4 minutes may be necessary.

Now develop the strip for the standard time recommended for the developer, rinse it briefly in the stop-bath and put it into the fixer. After it has had a minute in an ordinary fixer, or less in a rapid fixer, examine it in a bright light. Probably the parts which have had the longest and shortest exposures are much too dark and much too light respectively; the part which has had 10 seconds may be a little too light and that which has had 20 seconds a little too dark. We can either guess that the correct exposure is 15 seconds, or make a more delicate test, exposing a second strip for 12, 14, 16 and 18 seconds. If there is any doubt about the contrast-grade, a good plan is to expose the second strip for the time known to be approximately correct—in this case 15 seconds—and examine it carefully for contrast. If the paper is too soft the image will look flat, and either the deepest shadows will not

be a full black or the lightest parts will be grey instead of white or almost white. If it is too hard the image will have a 'staring' look and detail will be lacking at one end of the scale or the other.

We are now ready to make the print. Expose the paper, put it into the developer, see that the solution covers it properly, and develop for the recommended time, rocking the dish throughout. Do not try to control the density or contrast of the image by developing for more or less than the standard time. Users of miniature cameras often under-develop their negatives in order to get a specially fine grain and then try to get prints of adequate contrast on normal papers by under-exposing their prints and developing them for 3 or 4 minutes instead of the 2 minutes normally recommended. (This applies to bromide papers; for contact papers the standard time is usually between 30 seconds and 1 minute.) Do not follow this bad example: if the negative is too soft to print normally on a normal paper, use a harder one. Better still, in future develop your negatives more fully and they will print well on normal papers in the normal way. Do not worry about grain. If the negative is developed in the right developer to the contrast required for printing on normal paper the grain will not be excessive.

When the time is up, remove the print (taking care not to crease it) and put it in the stop-bath. After rinsing allow it to drain for a few seconds and put it in the fixer. Fresh Amfix at the right temperature will fix a sheet of single-weight bromide paper in 30 seconds. In practice, solutions are not always fresh, temperatures are not always right, and with heavy papers a little more time may be needed for the solution to penetrate the material and drive out the

residue of the developer and stop-bath. For safe fixing, allow 2 or 3 minutes with continuous rocking during the first 30 seconds and intermittent rocking thereafter. If an ordinary fixer is used allow 10 minutes, or 5 minutes in a solution previously used followed by 5 minutes in a fresh one. The same two-bath treatment can be used with Amfix and prolongs the life of the fixer: about 1 minute in each bath should suffice. When fixing is complete, take out the print, allow the excess solution to drain back into the bath and put the print in water. At the end of the session wash single-weight prints for 30 minutes in running water or in six 5-minute changes of still water, and double-weight prints for twice as long.

As a rule, the most difficult negatives to print are those of excessive contrast. Sometimes all parts of a negative may lie within the exposure-scale of a normal paper except one part which corresponds to a particularly light part of the subject, such as the sky. The sky could be brought within the exposure-scale by using a softer paper, but then the print as a whole might look too flat. The problem can often be solved by using a normal paper and giving additional exposure to the sky while shading the rest of the picture with a piece of card, which must be held some inches from the paper and kept on the move. Similarly, a part of the image which corresponds to a thin part of the negative can be shaded and so prevented from blocking up, while the rest receives normal exposure. Additional exposure can be given to small areas through a hole torn in a piece of card large enough to shade the whole image. Photographs of objects against light backgrounds can often be improved by giving additional exposure to the corners and

edges of the print. Whenever shading or 'burning in' is practised, the pieces of card or other tools used *must* be kept moving and manipulated so that the part which has had more or less exposure blends with the rest. For shading small areas, small pieces of card can be mounted on handles of stiff wire. The shadow of the wire will not show in the print if the whole instrument is kept on the move.

If the negative is of too high a contrast to print on the softest paper available and shows a great variety of tone throughout the image, these methods are impracticable. The only remedy is to extend the scale of the paper by modified development. Over-exposure and under-development is not a satisfactory solution because it nearly always gives poor colour. Amidol developers, however, will sometimes give quite good colour with less than normal development. Alternatively, an amidol developer can be diluted with several volumes of water, exposure increased, and development continued until the right density is reached. If exposure and development have been correctly adjusted, the result should be a print of normal colour with some compression of the shadow tones and good separation of the higher values. With chlorobromide papers developers designed to give a brown image can be used in the same way. The weakness of this combination is that the colour is strongly affected by the time of development; to arrange the exposure and development so that the right density, the right contrast and the right colour are all obtained at the same time is far from easy. Plain metol developers and MQ developers with a low proportion of hydroquinone can also be made to give soft images on bromide papers, without the

adverse effect on colour which results from curtailed development in a standard developer.

Conversely, a negative too flat for the hardest paper available can sometimes be made to give a good print by developing the paper in a high-contrast developer. 'Contrast' and 'press contrast' developers are suitable. In other cases, the only remedy may be to intensify the negative by the method described in Chapter IV.

As a rule, the variations in contrast achieved by abnormal development are very small. Much the best results are obtained by exposing and developing negatives correctly, so that they will print on normal papers by normal methods. It cannot be too strongly emphasised that the photographer's proper target is a negative from which good prints can be easily made, and not necessarily the 'technically perfect negative' of the text-books, which is often of too great a density-range to print on modern papers. The vigorous negatives admired thirty or forty years ago were designed for printing-out papers and would be too hard for the normal bromide and contact papers of today.

6

DRYING

DRYING is an important stage in the making of a print. If it is not done properly the paper will not show the 'finish' which it is designed to give. Both the superficial attractiveness and the technical quality of the print will suffer accordingly. The image always loses some contrast as the paper dries. If drying is standardised, the loss can be allowed for (and with glossy papers will be quite small). On the other hand,

careless and haphazard drying may lead to a marked and incalculable loss of contrast, so that what appeared to be a successful print when it lay in the dish may turn out a failure.

Glossy papers can be quickly dried with a high gloss by holding them in contact with a heated plate in one of the machines sold for the purpose. The maker's instructions should be followed. A slower but equally effective method of mechanical glazing is to squeegee the wet prints into contact with ferrotype or glass plates and leave them to dry without heat. They must first be soaked in a glazing solution and a little of the solution should be swabbed over the plate, which must be scrupulously clean. The solution should be filtered to exclude particles of grit which might pit the surface, and the print must be in intimate contact with the plate at every point. The plates should be stood on end in a cool place; no attempt must be made to strip the prints from them prematurely. They are sure to take several hours to dry, and may take all night. When they are dry the prints will fall off of their own accord or come away cleanly as soon as a corner is lifted. If any force is used they will be marked by ridges like those left on a sandy shore by the receding tide. Plate-glass gives the highest gloss, and single-weight papers are the easiest to glaze.

Mechanical glazing is suitable for prints intended for reproduction in books and periodicals and for glossy papers only. Glossy papers intended for other purposes, and all other papers, should be dried naturally in the following manner:

Begin by draining the prints thoroughly. Then lay them face upwards in a rough pile in a large dish. Wipe the surface of the topmost print with a swab of

cotton-wool soaked in water and wrung almost dry. Remove the print and put it face upwards on a towel or well-washed sheet laid on a flat surface. Wring out the swab and wipe the surface of the print with it until no free drops of water remain. Do not skimp this part of the process, which may take several minutes and must be continued until the surface looks almost dry. Meanwhile the towel or sheet will have absorbed water from the back of the print, which consequently need not be wiped. Now put the print face *downwards* on another part of the towel or sheet (or on another similar sheet) and continue with the next print. Leave the prints to dry for several hours, or preferably all night. At the end of that time they will be in a condition which can be described as dry but not bone-dry. At that stage remove them from the sheet or towel and put them face *upwards* in piles of not more than half a dozen each between *smooth* cards. Leave them under moderate pressure (the weight of a few books) for 12 hours if possible. At the end of that time they should be bone-dry and almost flat. Any remaining tendency to curl can be removed by putting them, one by one, face *downwards* on a dry smooth card, damping the backs with a moist swab and leaving them, again under moderate pressure, for half an hour or so. The last operation is not always necessary, but is an infallible method of removing the last trace of curl if done when the prints are quite dry and not before. The time-honoured methods of removing curl described in most text-books—such as drawing the prints over the edge of a table or stroking them with a ruler—are usually ineffective and likely to do more harm than good.

Glossy prints dried in this natural manner are left

with a moderate sheen which shows the image to the best advantage and is ideal for most purposes. Other papers are left with the appearance intended by the manufacturer. Any attempt to hasten drying by applying heat, except in the case of glossy prints mechanically glazed in the manner first described, is likely to impair the finish and should be avoided.

7

FINISHING

THE OPERATIONS known collectively as finishing include the removal of flaws, the trimming of margins, and sometimes mounting.

White spots on the print (caused by dark spots or specks of dust on the negative) can be touched out with body colour or transparent dye. Martin's Retouching Dye (obtainable in black, grey and brown) is recommended. The author's method of using it is to put a few drops in a saucer and leave them to dry. A fine camel-hair brush (No. 0) is then almost imperceptibly moistened and a little of the dye is taken up on the point. The brush is held almost perpendicular to the print and the spot touched with the point of it. Unless the spot is very small and the surroundings are very light several touches will be needed. The secrets of successful spotting are to use an almost dry brush and let each touch dry (which usually takes only a few seconds) before applying the next. If a mistake is made the dye can be wiped off with a damp swab without harming the print. When *bone-dry* it is virtually permanent and the repair will be undetectable.

Spotting with body colour (opaque water-colour or photographic spotting medium) is more difficult. The required tone cannot be built up by repeated touches laid one above another as with transparent dyes: the pigment must be mixed so that it exactly matches the area adjacent to the spot and applied with one deft touch. For those who have the necessary skill it is, however, a useful method of covering relatively large areas, which can be filled in with repeated touches laid side by side.

Dark spots on the print (caused by clear spots on the negative) can be covered with body colour, but if dyes are used for spotting they must be scratched out with the point of a sharp knife. The result is usually a white spot which must then be touched with dye to match the surrounding surface. The repair will be visible on close inspection, but scarcely so at the ranges at which whole-plate and larger prints are customarily viewed.

The trimming of margins is best done with the special equipment sold by photographic dealers. Trimmers of the 'desk' type are the easiest to use. At a pinch the job can be done with a sharp knife and a steel rule, but the difficulty is to find a suitable surface on which to lay the print. Glass, stone or marble is not easily scratched but soon wears out the knife. A smooth but yielding surface like linoleum is perhaps as good as any, or a large piece of thick card can be used and replaced when it is cut through.

Prints for exhibition are usually mounted on plain white boards. Boards measuring 15 × 12 inches are suitable for whole-plate and 10 × 8-inch prints; those for larger prints should be proportionately bigger, but the organisers of public and private

exhibitions often impose a limit of 20 × 16 inches. The most efficient method of mounting is by means of dry-mounting tissue, which melts when moderate heat is applied to it and makes a perfect junction between print and mount. For large prints a heated press is almost indispensable, but those smaller than 10 × 8 inches can be managed quite well with a domestic iron. Instructions are supplied with the tissue, which is stocked by photographic dealers. Pastes and gums are often difficult to apply without damaging the print, and may in course of time penetrate to the image and cause it to fade or tarnish. Special photographic pastes are warranted against this fault, but some skill is needed to use them so that none of the paste oozes from the edges on to the mount or gets on to the surface of the print. Rubber gum has a big advantage in this respect, as it can be rubbed off when dry without leaving a mark, even on the most highly glazed print. Moreover, a print can be stripped from the mount after hours, days, months, or even years, and transferred undamaged to another.

Prints on matt and half-matt papers are sometimes improved by varnishing. The brightness-range is increased and so the print regains some of the contrast lost on drying. Various proprietary varnishes such as Printamol are sold for the purpose. If the varnish is applied after mounting, great care must be taken to protect the mount. On the other hand, if it is applied earlier it may grow sticky or be rubbed off in the process of mounting. It can be applied with a brush or swab of cotton-wool or sprayed on with an instrument like a scent-spray. Varnishing has no useful effect on glazed prints and raises the brightness-range of unglazed glossy prints only very slightly.

8

POSITIVE TRANSPARENCIES

THE POSITIVE print need not be made on paper. It can be made on transparent material so as to form a lantern-slide, miniature transparency or film-strip. The product can then be projected to illustrate a lecture or otherwise point a moral or adorn a tale.

The standard size for lantern-slides in the United Kingdom is $3\frac{1}{4} \times 3\frac{1}{4}$ inches. About $\frac{3}{4}$ inch must be allowed for masking and binding; hence the longer dimension of the picture cannot much exceed $2\frac{1}{2}$ inches and the size of an image of the ordinary proportions will be of the order of $2\frac{1}{2} \times 2$ inches. If the negative—or the part of it to be used—is larger the slide must be made by reduction.

Like printing papers, lantern-plates are made in two kinds suitable for contact printing and for projection printing (in this case reduction rather than enlargement) respectively. The procedure does not differ essentially from that for ordinary printing, but the lantern-plate should be so exposed and developed that detail is visible in all parts of the image, and the shadows are not opaque. Practically any developer suitable for bromide papers can be used, as well as many suitable for negatives, but the safest course is to follow the recommendations of the manufacturer. The owner of an enlarger which provides or can be fitted with the necessary extension is advised to make his slides by projection, whether reduction is necessary or not. Difficulties of masking and of holding the negative and slide straight in the printing frame are avoided and composition is much easier. Lantern-plates of the

kind usually called 'special' or 'rapid', correctly developed in an amidol or MQ developer, give images of a good neutral colour. Chlorobromide and chloride plates will give colours ranging from off-black to red according to development. After development the slides must be fixed, washed and dried in the ordinary way. When each slide is quite dry the margins are masked off with black paper and it is bound up with a thin glass 'cover-plate' which protects the emulsion side from damage. To ensure dryness, first warm the slide and cover-plate gently. Small discs of white paper should be stuck to the face of the slide near the top edge in order to show which way round and which way up it should be put into the projector.

Positive transparencies from 35-millimetre film are usually made by contact on positive film, which should be processed according to the manufacturer's instructions. Special printing machines can be bought for the purpose. The positive transparency can be left in the form of a continuous strip, or the frames can be cut off and mounted separately between thin sheets of glass measuring 2 inches square. (The standard size for miniature transparencies including colour transparencies.) The tedious work of masking and binding can be avoided by buying ready-made transparency holders of glass and metal.

CHAPTER VI

SUBJECTS AND PROBLEMS

1

GENERAL

THE PRINCIPLES of photography are the same in all its branches. Study the subject, choose a viewpoint which shows it clearly, give the shortest exposure that will record the shadows properly, develop for a time calculated to bring the highest values to the proper density—these rules apply to every case. Nevertheless, some subjects do pose problems of their own. It is best to anticipate these difficulties and be prepared to meet them.

2

ARCHITECTURE

THE PROBLEMS of architectural photography arise largely from the great size of many buildings, the restriction of viewpoint by the building itself or by other buildings, and the need to show the detail of the subject clearly as well as its general shape. A distant view of a cathedral which revealed its surroundings but showed little detail in the building itself might be a good picture but would not be a good architectural photograph. From the standpoint of the specialist it would have value only if included in a set which also included nearer views and close-ups.

Sometimes a large building can be successfully photographed with a miniature or folding roll-film

camera from an upper floor of a neighbouring house or from some natural eminence. But the chances of finding such a point of vantage are remote. More often it is necessary to retreat so far, in order to include the whole of the subject without tilting the camera, that the image on the negative is reduced to insignificant proportions, even if the view is not obscured by other buildings or natural features. Such difficulties can only be overcome by using a camera with a wide range of adjustments and a battery of lenses. Advantage can then be taken of any viewpoint that occurs, and the photographer can make sure of getting an image of the right size from that viewpoint. A large negative is also an advantage, if only because it makes the composition of the image on the ground-glass much easier. Nevertheless some good architectural photographers do all their work with cameras no larger than quarter-plate.

The worst cases are buildings with tall spires. Often they are hemmed in by other buildings so that the only possible viewpoint is one which makes it impossible to include the whole without using a wide-angle lens. In the nature of things a wide-angle lens works near the limit of its covering-power: if the front of the camera is raised to exclude the foreground and bring the top of the spire into view, it will cease to cover, and the corners of the image will be cut off. Moreover, in many cases the design of the camera restricts the upward movement of the lens-panel when it is racked back to take a wide-angle lens. In such cases the problem can only be solved by tilting the whole camera and using the swing-back to restore the plate to its true position. A plumb-line or a spirit-level of protractor type should

be used to make sure that the back is strictly vertical. The image is now out of focus and the top and bottom of the plate are at different distances from the centre of the lens. Careful re-focussing is necessary, and the smallest stop must be used to get the whole image acceptably sharp. The simplest method is to focus at full aperture on some object near the centre of the plate and then stop down. If the top and bottom of the picture are still not sharp, adjust the focus (alternately opening and closing the diaphragm) until an acceptable compromise is found. If these efforts fail, the attempt to photograph the building from that viewpoint must be abandoned; probably the only solution will be to get permission to take the photograph from a neighbouring window.

A wide-angle lens should not be used unless the conditions make it necessary. A standard or a long-focus lens and a more distant viewpoint give more natural perspective, the adjustments are more easily made, and if the camera is set slightly off an even keel the results are not quite so disastrous. Nevertheless, with any lens great care should always be taken to avoid this fault.

Architectural interiors are generally less difficult to photograph than they appear. In some cases artificial lighting may be needed, but more often the dimness of the natural lighting can be overcome simply by giving a long exposure—sometimes as much as half an hour or an hour. If people walk into the field of view, close the lens and open it again when they have gone. Permission to photograph the interiors of buildings, whether public or private, must be sought in advance from their owners or custodians. Arrangements can sometimes be made to take the photo-

graph at a time which will exclude the risk of interruptions.

As architectural photography often involves subjects of high contrast, many photographers advise soft-gradation plates, but equally good or better results can be had with plates and films of normal or fairly steep gradation carefully developed. It is worth remembering that a large number of architectural photographs which have never been surpassed were taken more than half a century ago with slow plates, very large cameras and old-fashioned lenses. Although a good anastigmat lens is to be preferred to any other, old 'aplanat' or 'rapid rectilinear' lenses are quite satisfactory at the small stops generally used for architectural photography. One advantage of slow plates is that exposures are long, and long exposures lessen the risk that the image may be blurred by any shake communicated to the camera when the lens is opened. Others are good gradation, high resolution, and fine grain. For all these reasons there is much to be said for plates of moderate speed and fairly high contrast, such as Kodak P.300 and 0.250, generously exposed and developed in a soft-working pyro-soda, para-aminophenol or metol developer.

Yellow, orange and red filters are useful to heighten the contrast between a light building and a blue sky, but exposure should be carefully adjusted to avoid harsh shadows. Similar filters can sometimes be used to bring out the grain or texture of wood and stone.

Architectural photographs should generally be printed on glossy papers to show detail as clearly as possible.

3

LANDSCAPE

THE LIMITS of landscape photography are very wide, and landscape photographs of one sort or another can be taken with almost any camera. For the classical open view in which the far distance figures prominently a large negative is best. Many pleasing photographs of scenery have been taken with the Leica and other miniature cameras, especially in mountainous country, but the definition seldom satisfies the most critical standards. However good the lens may be, the extreme scale of reduction and subsequent magnification involved in photographing an immense tract of country on little more than a square inch of film sets a formidable problem. The resolving power of the emulsion is likely to be strained to its limit and the irreducible minimum of camera-shake caused by the movement of the shutter may have an appreciable effect even when the camera is on a tripod.

In general, open views should be attempted with small cameras only in the early morning or evening and with strong oblique lighting which gives relief to the distant scene. At other times of the day it is best to stick to scenes in which the interest is concentrated on the foreground. A glimpse of the far distance may be included, but it should not take up too much of the picture. If prominent objects near the camera are sharply rendered, a slight falling off of resolution in the far distance is tolerable. A yellow or orange filter helps to reduce the effects of haze. The exposure should be the bare minimum which will render the foreground adequately, and some under-exposure of

foreground shadows may be necessary in order to avoid severe over-exposure of the background.

With a quarter-plate or larger negative the landscape photographer has wider scope. The same broad principles apply, but quite flatly-lit scenes can be attempted and fairly full development can be given to increase contrast. Conversely, strongly-lit scenes with bold foregrounds can be fully exposed, and a compensating developer can be used to bring out detail in the foreground shadows without giving too much density to the lighter parts.

As a rule, lenses of about one-and-a-half times or twice the standard focal length give the most satisfactory perspective for landscape shots. Standard and wide-angle lenses tend to dwarf the background and are useful when that is the effect desired. Panchromatic films and plates of moderate speed are generally considered best; they can be used with deep yellow and orange filters to give bold skies. To render bright-green foliage as light against a darker sky, use a yellow-green filter. The glittering effect of sunlit foliage and growing crops can sometimes be enhanced by a light-red filter, but the filter will darken green leaves which do not directly catch the light. With long-focus lenses the problem of depth of field is often acute; the focus and the stop must be carefully adjusted to make both foreground and background sharp. When there are no objects with marked vertical lines in the foreground or when a high viewpoint can be chosen, it may be possible to increase the depth of field by pointing the camera slightly downwards and swinging the back. Focus first on the far distance; then pull out the top of the back until the foreground is also sharp, re-focussing if necessary. When the

amount of swing required to bring the foreground into focus is the same as that required to restore the back to the vertical plane, the method can be used to photograph buildings from a high viewpoint against a landscape background.

4

PORTRAITURE

OUTDOOR portraiture by bright, diffuse light presents no special problems and can be undertaken with any camera capable of focussing down to 6 feet or less. Lenses of considerably more than the standard focal length are best, but are not essential for full-length and half-length portraits. In strong sunshine artificial reflectors or flash equipment must be used to light the shadows, unless natural reflectors such as water or a whitewashed wall are available. Exposure must be adequate to ensure detail in shadowed parts of the face such as the eye-sockets, and a soft-working developer is advisable. Miniature cameras with their long-focus lenses are particularly suitable, and so are fine-grain developers.

Indoors, the problem is to provide enough light to give a reasonably short exposure without dazzling the sitter. Photofloods are harsh and trying to the eyes unless diffused by gauze or muslin. Many professional portrait photographers use extremely powerful but well diffused lights; but as they also use large cameras with long-focus lenses which have to be stopped down to give a useful depth of field their exposures are not necessarily very short. A further difficulty is that with an orthodox studio camera the substitution of the

plate-holder for the focussing-screen introduces a considerable delay. The sitter may not be able to hold the pose without becoming rigid, and only an experienced model can be expected to remember it and take it up again after an interval of relaxation. Hence there is much to be said for a miniature reflex like the Primarflex or the Exakta. With such an outfit the photographer can watch the image of the sitter on the ground-class screen and expose when he thinks fit. The sitter need not be asked to pose, and if there is enough light for instantaneous exposures need not even sit still. The depth of field is greater than with large lenses of comparable performance, and recognisable objects can be included in the background. At the same time, the photographer should always take care to focus sharply on the eyes.

The principles of lighting are the same for portraiture as for any other subject, but special pains must be taken to light up parts of the face which the main light leaves in shadow. As the seat of expression, the eyes have an importance out of proportion to the space they occupy in the picture, and must be clearly shown. As often as not, the background, being further from the main sources of illumination than the sitter, must be separately lit by a concealed lamp, and another—preferably a spotlight—may be needed to light the hair. Fairly fast films of reasonably soft gradation should be used and a fine-grain or other soft-working developer is best.

Filters are seldom needed for indoor portraiture, although occasionally a blue one may be useful to lighten blue eyes and darken red lips. Out of doors, when the background is blue sky, a yellow-green filter is most useful.

The photographer should not try to interpret the character of the sitter by an esoteric process but should study the forms and contour of the sitter's face as objectively as possible and do his best to capture what he sees. Remember that the head is solid; the object is to convey its solidity on a flat surface. The lens will record quite faithfully what is visible from its particular viewpoint; what is invisible cannot be recorded. The sitter's appearance can of course be modified by dress, make-up, lighting and viewpoint, but if he or she is paying the photographer or sitting to oblige him the photographer should consider carefully how far he is justified in employing such means to emphasise, perhaps to the verge of caricature, some aspect which may be less characteristic than he thinks. On the other hand, a paid model can legitimately be asked to pose as the embodiment of any pleasant or unpleasant quality, but for personal or professional reasons which must be respected may not wish to appear in an unfavourable guise.

5

STILL LIFE

To THE photographer still-life subjects are perhaps the most satisfactory of all. Human and romantic irrelevancies are excluded and he is free to concentrate on his real interests, form and texture. The subject can be arranged at will, and lighting, exposure and development can be adjusted to give almost any desired effect and degree of contrast. • Inanimate objects do not become irritable or nervous if the session is long, and do not expect the photographer to

flatter them. They do not wave in the wind because indoors the wind can be excluded, and if artificial light is used they are not affected by changes in the weather. The photographer works in the privacy of his home or studio and is not bothered by children who kick over his tripod or insist on being photographed. Obviously there is a reverse side to the medal. The photographer who remains at home and confines himself to stocks and stones tastes an austere pleasure not to be found in the outside world, but he misses the stimulation as well as the exasperation which comes of dealing with living things.

At the close ranges generally used for still-life photography, most view-finders are hopelessly inaccurate. A camera with a focussing-screen is therefore almost essential. Some cameras with view-finders can be fitted with special devices for close-up photography, but they seldom provide a complete answer to the problem; alternative plate-backs are, however, quite satisfactory. Short-focus lenses are sometimes recommended on the ground that they give greater depth of field; but the author's own preference is for lenses of about twice the standard focal length, since they enable the photographer to get further from the subject and so avoid unduly steep perspective. Both field and miniature reflex cameras fitted with such lenses are eminently suitable, although the lack of a swing-back restricts the usefulness of the latter for some shots. As a rule still life is photographed from slightly above, and it is often an advantage to be able to swing the back and thus prevent the convergence of lines which ought to be parallel.

The arrangement of objects and choice of viewpoint are matters of taste, but the reader may think it worth

while to pay some attention to the points made in Chapter II, section 3. Backgrounds demand careful study, otherwise unwanted and perhaps unnoticed objects are sure to intrude into the composition. A useful property is a large sheet of paper or fabric on which the objects can be stood and which is then bent up behind them and secured to some support outside the picture in order to provide a continuous ground. A sheet of white blotting-paper provides a blank ground (except in so far as the objects may cast shadows on it) and a piece of wallpaper or patterned wrapping-paper a variegated one. If the objects are simply stood on a table and a piece of card put behind them the junction of the table and the card will show as a hard horizontal line which may be disturbing. Textiles are often less satisfactory than paper because of their tendency to fall into folds and creases.

The light can be provided by photofloods or spot-lights, but beware of harshness. Gauze or muslin diffusers may be useful, or the lamps may be turned away from the subject and reflected back to it from large pieces of white card. Ordinary room lighting is often as good as any. Exposures will be long—perhaps a quarter of an hour or more if small stops are used—but that is no handicap so long as the objects are not moving. If a meter is used from the position of the camera about twice the indicated exposure should be about right for a subject of average contrast. If the subject is weakly lit and of low contrast give the indicated exposure and develop fully. Remember that if the lens of a large camera is extended for a close-up an allowance for the additional extension may be necessary. The method of calculating it is given in Chapter III, section 4.

Objects made of glass or highly polished metal sometimes cause difficulty because of their exceptionally brilliant highlights. The reflection can be damped down either by using a polarising filter on the lens or by photographing the object inside a muslin tent or tunnel.

6

STREET SCENES, ANIMALS AND GENRE SUBJECTS

STUDIES of people in streets or market-places, domestic pets or wild animals in captivity are best taken with a hand camera, and if the subjects are to be photographed without their knowledge it must be small and inconspicuous. In many ways a range-finder miniature like the Leica or Contax is ideal, but it can be argued that a reflex or twin-lens camera used at waist-level is less likely to attract attention. For obvious reasons a tripod is usually ruled out, and in many zoos, parks and similar places where the best subjects are often found photography with a tripod is not permitted, although hand cameras are tolerated or encouraged.

The chief stumbling-block in this kind of photography is the assumption that an interesting subject necessarily makes an interesting picture. Unhappily this is no more true of photography or any kind of graphic representation than it is of literature. A description of a battle or an earthquake can be just as dull as a description of a parish meeting, and nothing could be more banal than many photographs of scenes which to the layman seem pre-eminently picturesque. As material for the artist a scene full of human or dramatic interest is of value only if those

qualities inspire him to make a better use of his medium. In other words, he must be aware of the humour, pathos or drama of the scene, but remain detached from it in order to exercise his craft. Simple subjects like the play of light and shade on water readily make good photographs because their appeal lies unmistakably in form and texture, and it is by form and texture that the artist gets his effects. Where the direct appeal of the subject lies in its human or romantic interest the over-riding importance of form and texture are apt to be forgotten, with the result that drawings and photographs of such subjects are too often merely sentimental or facetious. Strip many 'human documents' of their propagandist element and the poverty of design which becomes apparent shows clearly that the artist forgot his real business.

It is impossible to lay down artistic rules for this or any other branch of photography, but the following practical hints may be of value.

Crowded markets and street-scenes are often best photographed from above. Pattern is emphasised and there is less tendency for one figure to hide another. Back lighting enhances the effects of space and depth. So far as the human interest of the subject is concerned, the detachment of the bird's-eye view adds to, rather than detracts from, the impression of bustle and activity.

Single figures and small groups—a young man talking to a girl, a pair of gossiping women—can be taken from any angle, but a point of vantage such as a balcony or first-floor window helps the photographer to work unseen and to detach the subject from a distracting background. As a rule a mere glimpse of the surroundings is enough to establish the atmosphere.

Film-directors and motion-picture photographers excel at this kind of shot, but enjoy advantages denied to the still photographer. The inevitable foreshortening is a drawback, and probably a long-focus lens will be needed. Here the miniature camera scores heavily, as a 35-millimetre camera can easily be fitted with a lens whose focal length is three times the diagonal of the negative. With larger cameras a focal length of more than twice the focal length is seldom practicable, but the print can be made from part of the negative.

Subjects which must be stalked, such as children and animals, are best taken at close quarters or with long-focus lenses so that they fill the whole picture. Probably the photographer will not be able to take them from a viewpoint which gives an ideal background, and the best solution is to let them blot the background out. Incidentally, stalking of human beings is seldom satisfactory; the photographer who can steel himself to ask a stranger to pose for him will seldom be refused. The chief difficulty is then to prevent the subject from falling into a stiff or self-conscious attitude. A useful if unscrupulous trick is to keep up a conversation while pretending to get the camera ready and take the shot before the subject expects it. For the second shot reverse the process; pretend to make the exposure when you cock the shutter and release it after the subject has relaxed. Always offer to send a print if the photograph is successful. Fortunately for photographers, many people take great delight in being photographed, and as country people generally get few opportunities of doing so the gift may give a lot of pleasure—a consideration which may help to overcome the photographer's natural reluctance to intrude on a complete

stranger. On the other hand, stalking is undoubtedly an impertinence and may cause offence. The photographer should always be ready to withdraw gracefully if he senses that his attentions have been noticed and are resented. In this case, at any rate, the real crime lies in being found out.

7

COPYING

THE PHOTOGRAPHY of prints, drawings, maps, documents and other flat objects is called copying. It can be done with any camera provided with an adequate extension, but to the use of an ordinary camera there are three objections, none of them insuperable but collectively quite strong.

The first is the difficulty of arranging the subject and the back of the camera in parallel planes. A single sheet can be pinned to a wall and the camera can be used in the ordinary position; a book or a framed picture must often be propped up at an angle, and to arrange the camera at precisely the same angle is not easy. The second is that ordinary camera lenses (as distinct from process and enlarging lenses) are seldom designed to give perfect sharpness over a flat field at the close ranges used for copying, although most will perform quite well when stopped down a little. The third is that a surface placed in roughly the vertical plane may catch reflections from objects behind the camera or from the camera itself.

These difficulties can be largely overcome by copying with an enlarger. Begin by putting the object to be copied on the baseboard; if necessary keep it

flat by placing a sheet of heavy plate-glass over it. Arrange lamps in reflectors on each side or at all four corners so that the surface is evenly illuminated. Now turn out the lamps, put a negative in the carrier of the enlarger, and focus the image on the surface of the material to be copied, arranging the distance so that the size of the projected image covers an area slightly greater than that of the material. Stop down far enough to make the image sharp all over. Next extinguish all lights except an appropriate safelight and substitute for the negative an unexposed plate or film, emulsion facing towards the lens. Put a piece of black paper on top of it, put the carrier in the enlarger and seal up the edges with paper or by wrapping a cloth round the enlarger, so that no light can reach the plate except through the lens. (A few enlargers have light-tight carriers but most do not.) Now expose by turning on the lamps, and afterwards develop, fix and wash the plate in the ordinary way. Plates or films of steep gradation, made for copying and process work, should be used and should be developed in accordance with the maker's instructions. Special films are made for copying on the greatly reduced scale involved in miniature work. Coloured maps and pictures need panchromatic or at least orthochromatic materials, and sometimes filters. Black-and-white drawings and photographs can be copied on 'ordinary' process materials. The exposure must be found by test until the photographer has gained enough experience to estimate it or has calibrated his exposure-meter against test exposures. If special materials are not available use a normal plate or film of fairly steep gradation—say P.300 or 0.250 plates or Pan F 35-millimetre film—and develop it in an energetic MQ

developer of the 'universal' type. The result is a negative from which prints which are more or less faithful copies of the original can be made in the normal way.

The photographer who wishes to undertake work of this kind should remember that he must not copy copyright material, even for his own amusement, without a licence from the owner of the copyright. The fact that he may not know who owns the copyright is no excuse; his duty is to seek out the owner or satisfy himself that copyright has expired. Remember also that there may be copyright in a copy even if that of the original has expired. Thus, if he wishes to reproduce an eighteenth-century print the photographer must not copy a reproduction of it in a modern book; he must buy a specimen of the original copyright-expired print and copy that. In the case of an unpublished work such as a painting, access and written permission to photograph should be sought from the owner or custodian.

8

COLOUR-TRANSPARENCIES

COLOUR-PHOTOGRAPHY with modern integral tri-pack materials like Kodachrome is rather easier from the user's point of view than black-and-white photography. The exposure-range of the material is small; consequently rather flat lighting, with the source of light behind the camera, is usually advised. If this rule is observed there are no exposure problems, and as the processing is usually done by the manufacturer of the material or by an experienced dealer there are

no development problems either. Some brands of colour-film can be processed at home, but the operations are complex and the amateur will do better to get the work done by an expert. The exposure can be taken from a meter-reading or from the table supplied with the film.

There are many different colour-films, but as most of them are available in only a limited range of sizes there is no point in describing them here: the photographer must buy what fits his camera. A distinction must however be drawn between *subtractive* materials like Kodachrome, which give a pure dye image, and *additive* materials like Dufaycolor, which give a mosaic image less suitable for high degrees of enlargement.

A few colour-films on the market are designed to give a negative from which any number of colour-prints or positive transparencies can be made. The majority are processed to give a single positive transparency designed for projection or viewing in a special viewer, but which also lends itself to the making of colour-prints. Unfortunately no cheap and simple method of making colour-prints from either class of material is yet available in the United Kingdom. The negative and positive transparencies can also be used for making colour-blocks for reproduction in the press, but the cost of the blocks is high and great enlargements from small-colour transparencies are not always satisfactory. In the great majority of cases the needs of the user will be confined to the making of positive transparencies for projection or viewing at home, and for this Kodachrome and a 35-millimetre camera are ideal.

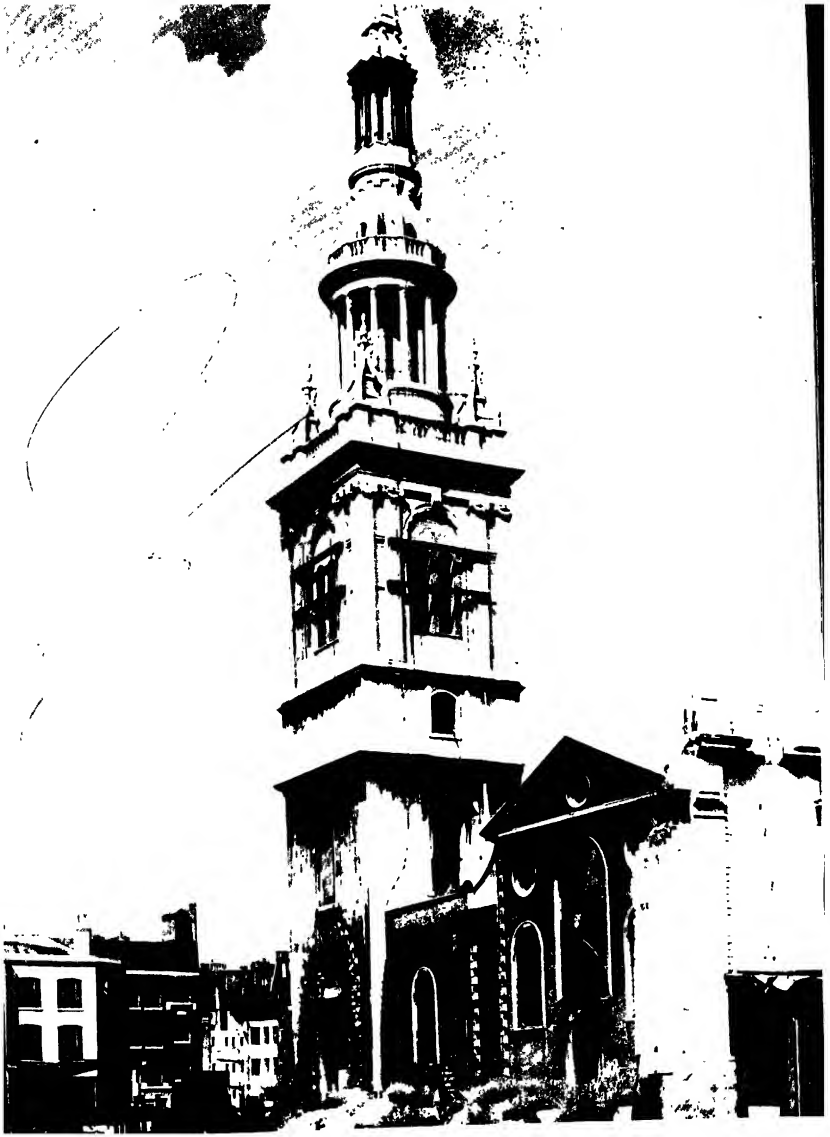

Plate 1 ST. MARY-LE-BOW, CHEAPSIDE

Technical camera; 5¼-inch symmetrical lens; 5 1-inch F.P.3 sheet film. Summer sunshine, subject of normal contrast. Normal exposure (½ second at f/32 with 10x red filter), development in D.25. Rising front used almost to limit of covering power of lens. No tripod; camera on ledge, wedged up with coins.

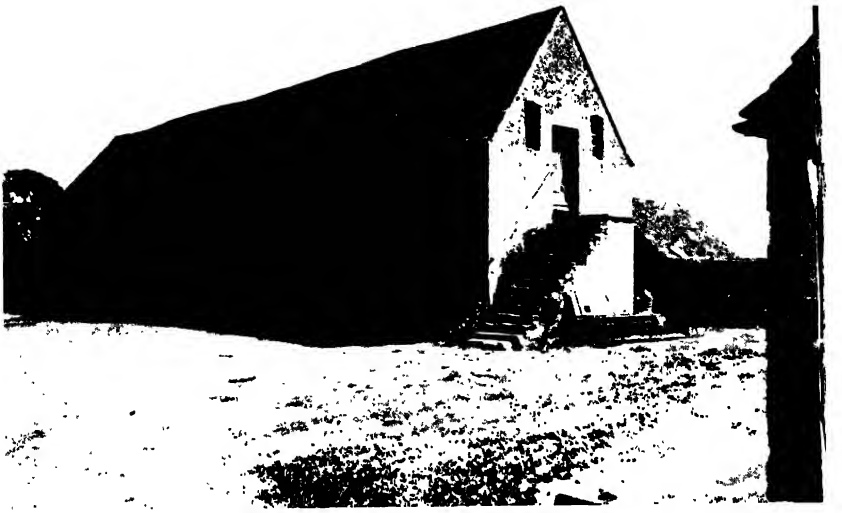

Plate COTSWOLD BARN

Technical camera; 3¼-inch coated wide-angle lens; 5 × 4-inch Panatomic-X sheet film. Summer sunshine, side-back lighting, subject of high contrast. Rather full exposure (1 second at f 22 with 6x red filter), moderate development in Rytol.

Plate 5 DESERTED HOUSE NEAR MONIEUX

35-millimetre reflex camera; 10.5-centimetre lens; Panatomic-X film. Spring sunshine, subject of normal contrast. Normal exposure $\frac{1}{100}$ second at roughly f 7 with 1.5X yellow filter, moderate development in Meritol-Metol. No tripod.

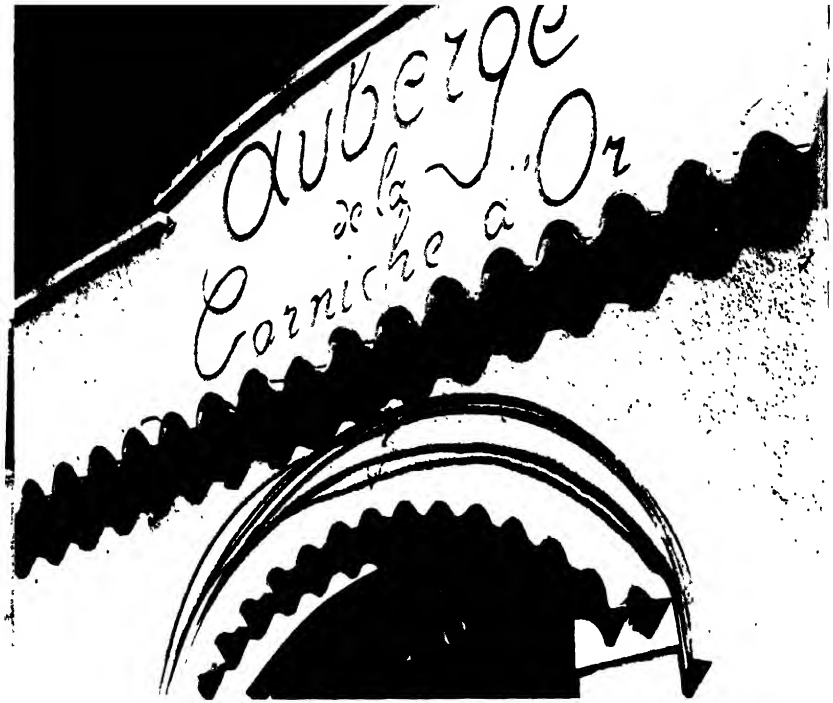

Plate 6 INN NEAR CANNES

35-millimetre reflex camera; 5.8-centimetre coated lens; Panatomic-X film. Summer sunshine, subject of high contrast. Minimum exposure $\frac{1}{100}$ second at f 9, with 2x yellow filter), normal development in G.D.203. No tripod.

Plate 7 (opposite) HOUSE AT REYNÈS

6 × 9-centimetre folding roll-film camera; 11-centimetre lens; Pernox film. Winter sunshine, subject of moderately high contrast. Minimum exposure $\frac{1}{25}$ second at f 4.5 with 10x red filter), moderate development in dilute pyro-soda. No tripod.

Plate 8 XIIITH-CENTURY GATEWAY,
WHITTINGTON CASTLE, SHROPSHIRE

Technical camera; 5-inch lens; 5 × 4-inch P.1200 plate; no filter. Dull light, subject of fairly low contrast. Full exposure ($\frac{1}{5}$ second at f/25), rather full development in D.23. Rising front used almost to full extent.

Plate 9 ROMAN CAPITAL, AIX-EN-PROVENCE

35-millimetre reflex camera; 7.8-centimetre coated lens; Panatomic-X film; no filter. Spring sunshine, subject of moderately high contrast. Normal exposure ($\frac{1}{60}$ second at f/45), moderate development in Meritol-Metol. No tripod.

Plate 11 GIANT CACTI, MONTE CARLO

35-millimetre reflex camera; 5.8-centimetre coated lens; Panatomic-X film. Exceptionally brilliant summer sunshine, subject of normal contrast. Normal exposure ([illegible] second at f/4 with 2x yellow filter), moderate development in Meritol-Metol. No tripod.

Plate 10 (opposite) AURIBEAU

35-millimetre reflex camera; 5.8-centimetre coated lens; Panatomic-X film. Early summer, early morning light. Subject of normal contrast. Normal exposure ($\frac{1}{25}$ second at f/11 with 5x orange filter), moderate development in Meritol-Metol.

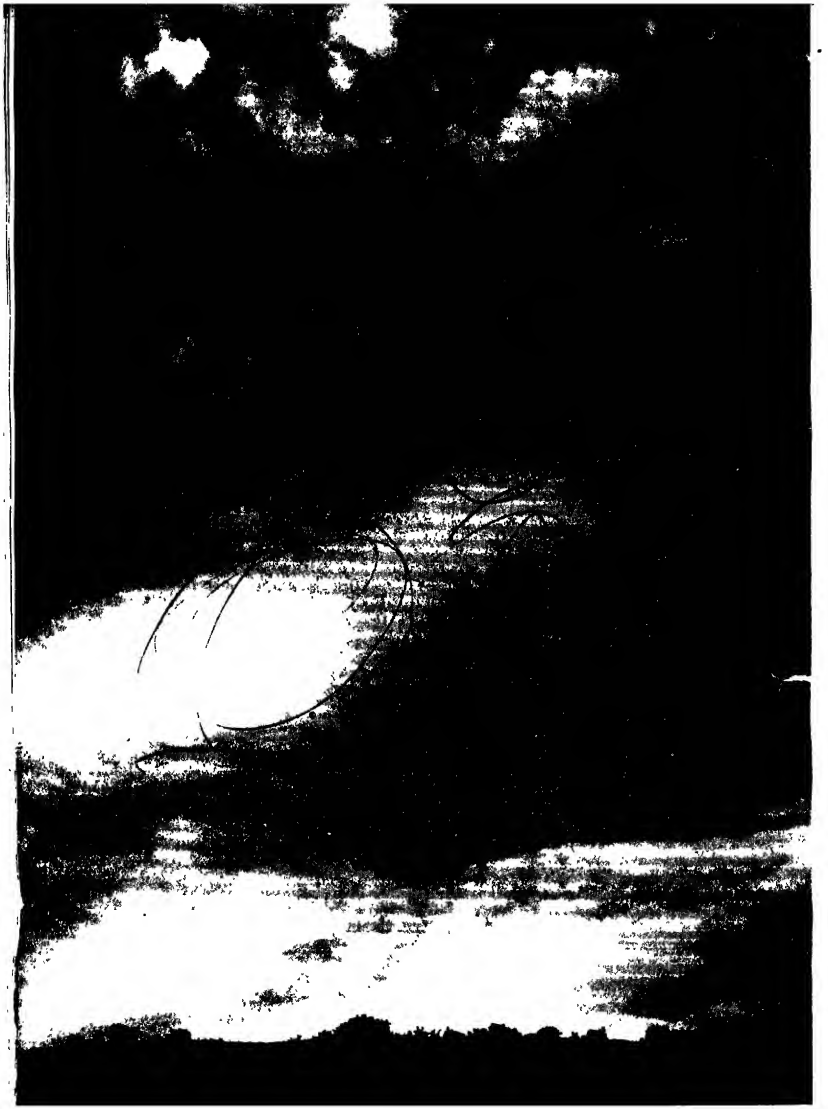

Plate 12 BIRD AND CLOUDS, DORSET

6½ × 9-centimetre folding roll-film camera; 11-centimetre lens; Panatomic-X film. Summer sunshine, subject of normal contrast. Minimum exposure ($\frac{1}{100}$ second at f 16 with 1.5× yellow filter), moderate development in dilute pyro-soda. Camera tilted. No tripod.

Plate 17 NEEDLE, THREAD AND SCISSORS

6 9-centimetre hand or stand camera; 10.5-centimetre lens; P.1200 plate. One photoflood in reflector, subject of high contrast. Minimum exposure (3 seconds at f 25), rather prolonged development in D.23.

Plate 18 CACTUS AND PINECONE

35-millimetre reflex camera; 10.5-centimetre coated lens; F.P.3 film. Two photofloods in reflectors. Subject of normal contrast. Normal exposure 1/25 seconds at f 16; moderate development in Johnson Super Fine-Grain.

APPENDICES

APPENDIX A

DEPTH OF FIELD TABLE FOR STANDARD LENSES

(*Note.* For miniature cameras and for lenses of much more than the standard focal length use the table in appendix B. The British and metric measurements are not exact equivalents, but differences of 0.5 cm. or less can be ignored.)

HYPERFOCAL DISTANCES
(feet)

FOCAL LENGTH OF LENS		STOPS									
ins.	*cms.*	*f*/2	*f*/2.8	*f*/4	*f*/4.5	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
2	5.0	84	60	42	37	30	21	15	11	8	6
3	7.5	126	89	63	56	45	32	23	16	12	8
3½	9.0	147	104	74	65	53	37	26	19	13	10
4	10.0	168	119	84	75	60	42	30	21	15	11
5	13.0	209	149	105	93	75	53	38	27	19	14
6	15.0	—	178	126	112	89	63	45	32	23	16
9	23.0	—	268	190	168	136	96	68	48	34	24
12	30.5	—	—	252	224	178	126	90	64	46	32

If the lens is focussed on infinity (∞) the field extends from the hyperfocal distance to infinity. If it is focussed on the focal distance, the field extends from half the focal distance to infinity. Thus if a 6-inch lens is focussed at 32 feet and stopped down to f/16, everything between 16 feet from the lens and the far distance will appear acceptably sharp on the resulting print.

The depth of field at other settings can be found by either of two methods:

Method 1

Take the hyperfocal distance for the appropriate lens and aperture. Divide it by the series 0, 1, 2, 3, 4 and so on up to any required number. (Any figure divided by 0=∞.) Write down the results in a line. The near and far limits of the field at the setting corresponding to any figure are then given by the figures on each side of it. For example, for a 4-inch lens at *f*/11 the series is:

∞, 30, 15, 10, 7·5, 6, 5, 4·3, 3·8, 3·3, 3

so that if the lens is set at 15 feet the field extends from 10 to 30 feet.

Method 2

Let H be the hyperfocal distance, D the distance focussed upon, D_1 the further limit of the field and D_2 the nearer limit. Then

$$D_1=\frac{H\times D}{H-D} \text{ and } D_2=\frac{H\times D}{H+D}$$

APPENDIX B

DEPTH OF FIELD TABLE FOR MINIATURE CAMERAS AND FOR LONG-FOCUS LENSES

(*Note.* The British and metric measurements are not exact equivalents, but differences of 0.5 cm. or less can be ignored.)

HYPERFOCAL DISTANCES
(feet)

FOCAL LENGTH OF LENS		STOPS									
ins.	*cms.*	*f*/2	*f*/2.8	*f*/4	*f*/4.5	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/22	*f*/32
1½	3.5	—	70	48	42	36	24	18	12	9	6
2	5.0	126	90	63	56	45	32	23	17	12	9
3	7.5	189	134	95	84	67	48	35	24	18	12
3½	9.0	220	156	110	98	79	56	39	29	20	15
4	10.0	252	180	126	112	90	63	45	32	17	16
5	13.0	315	225	158	140	112	79	56	40	28	20
6	15.0	- -	268	189	168	134	90	67	45	34	23
9	23.0	—	402	284	252	201	142	102	72	51	36
12	30.5	—	—	380	336	268	190	134.	96	67	48

If the lens is focussed on infinity (∞) the field extends from the hyperfocal distance to infinity. If it is focussed on the hyperfocal distance, the field extends from half the focal distance to infinity.

The depth of field at other settings can be found by either of the methods described in appendix A.

APPENDIX C

RECOMMENDED SOLUTIONS

THE FOLLOWING is a selection of developers and other solutions which have been found useful. The standard developers recommended by the leading manufacturers of films and plates are not given, as the formulas can be easily obtained from the leaflets supplied with the materials. Alternatively the developers can be conveniently and economically made up from prepared packages.

To make up a solution, begin with about two-thirds of the specified volume of water at about 130 degrees Fahrenheit. If possible use water that has been boiled for a few minutes. Add the ingredients one by one in the order prescribed, stir well and allow each to dissolve completely before adding the next. Finally add cold water to make up the full volume. Filter the solution through a filter-paper or a piece of cotton-wool if it is not clear.

The formulas are given below in metric form and also in grains and fluid ounces. The two versions do not correspond item by item and therefore one version or the other must be followed throughout.

Potassium metabisulphite can be substituted for sodium bisulphite in equal quantities. If crystals of sodium sulphite and sodium carbonate are used instead of the anhydrous forms, use twice and 2.7 times the respective weights.

Negative Developers

1. THREE-SOLUTION PYRO
(*Kodak D.1*)

Solution A		
Sodium bisulphite	9.8 gm.	69 gr.
Pyrogallol,	60.0 gm.	420 gr.
Potassium bromide	1.1 gm.	8 gr.
Water to make	1 litre	16 oz.

Solution B		
Sodium sulphite, anhydr.	105.0 gm.	735 gr.
Water to make	1 litre	16 oz.

Solution C		
Sodium carbonate, anhydr.	75.0 gm.	525 gr.
Water to make	1 litre	16 oz.

Solutions A and C keep well, but in a partly-filled bottle solution B begins to lose its virtue after about two weeks.

For dish development, take one part each of A, B and C and seven parts of water. Develop for 5 to 7 minutes at 65 degrees Fahrenheit (18 degrees Centigrade).

For tank development, take one part each of A, B and C and 11 parts of water. Develop for 7 to 12 minutes at 65 degrees Fahrenheit (18 degrees Centigrade).

For compensating development and fine grain, use at tank strength but with one-third of the usual quantity of C. Develop for 15 to 30 minutes (dish) or 20 to 40 minutes (tank) at 65 degrees Fahrenheit (18 degrees Centigrade).

2. TWO-SOLUTION PYRO

(*British Journal Photographic Almanac*)

Solution A		
Potassium metabisulphite	18.3 gm.	128 gr.
Sodium sulphite, anhydr.	75.0 gm.	525 gr.
Pyrogallol	18.3 gm.	128 gr.
Potassium bromide	4.6 gm.	32 gr.
Water to make	1 litre	16 oz.

Solution B		
Sodium carbonate, anhydr.	56.0 gm.	392 gr.
Water to make	1 litre	16 oz.

The solutions keep well. For normal use, take one part each of A and B and two parts of water. Develop for about

8 to 12 minutes (dish) or 10 to 15 minutes (tank) at 65 degrees Fahrenheit (18 degrees Centigrade). For negatives which have had minimum exposure and for slight compensating action and reasonably fine grain, take one part each of A and B and six parts of water. Develop for about 12 to 20 minutes (dish) or 15 to 25 minutes (tank) at 65 degrees Fahrenheit (18 degrees Centigrade). If high contrast is wanted these times may be considerably increased without risk of excessive fog or stain. A more marked compensating action can be obtained by taking one part each of A and B and fourteen parts of water and developing for about 15 to 25 minutes (dish) or 25 to 40 minutes (tank) at 65 degrees Fahrenheit (18 degrees Centigrade).

3. SIMPLE FINE-GRAIN DEVELOPER
(*Kodak D.23*)

'Elon' (metol)	7.5 gm.	53 gr.
Sodium sulphite, anhydr.	100.0 gm.	700 gr.
Water to make	1 litre	16 oz.

Keeps well and can be used repeatedly. A litre should develop at least six roll films (120 size) or twenty-four 5×4-inch plates before becoming exhausted, but the development time must be increased by about 10 per cent for each film (or equivalent number of plates or sheet films) after the first.

For dish or tank development use at full strength. Develop for about 10 to 15 minutes (dish) or 15 to 22 minutes (tank) in fresh solution. These times can be reduced by at least a third for subjects of high contrast and more than doubled for subjects of low contrast. Although described as a fine-grain developer, D.23 is of wide application and is one of the best all-round developers known.

4. DEVELOPER FOR VERY FINE GRAIN
(Johnson Meritol-Metol)

Metol	2.3 gm.	16 gr.
Sodium sulphite, anhydr.	90.0 gm.	630 gr.
Meritol	13.7 gm.	96 gr.
Water to make	1 litre	16 oz.

Keeps quite well and can be used repeatedly. A litre should develop five or six roll films (120 size) or the same number of 36-exposure strips of 35-millimetre film before becoming exhausted. The development time should be increased by about 10 to 15 per cent for each film after the first.

Use at full strength. Develop for about 7 to 13 minutes (tank) in fresh solution at 65 degrees Fahrenheit (18 degrees Centigrade).

The developer can be bought in dry form ready for making up and also in solution form. Detailed tables of development times for various films are supplied.

Negatives to be developed in Meritol-Metol should have had about 50 per cent more exposure than usual. Roll films should be given a preliminary soak in plain water (see Chapter IV) to remove the coloured backing.

5. DEVELOPER FOR STILL FINER GRAIN
(Johnson Super Fine-Grain)

Sodium sulphite, anhydr.	90.0 gm.	630 gr.
Meritol	16.0 gm.	112 gr.
Water to make	1 litre	16 oz.

Keeps quite well and can be used repeatedly. Should develop about the same number of films as Meritol-Metol and the time should be increased in the same proportion. Use at full strength and develop for about twice the times given for Meritol-Metol. Negatives should have had about three or four times normal exposure for the best results. Roll films should be given a preliminary soak.

The developer can be bought in dry form ready for making up and with tables showing the recommended times of development for various films.

6. HOT-WEATHER DEVELOPER FOR VERY FINE GRAIN (*Kodak D.25*)

'Elon' (metol)	7.5 gm.	53 gr.
Sodium sulphite, anhydr.	100.0 gm.	700 gr.
Sodium bisulphite	15.0 gm.	105 gr.
Water, distilled or boiled, to make	1 litre	16 oz.

Use in the same way as D.23 and develop for the same times, but at 77 degrees Fahrenheit (25 degrees Centigrade). Negatives should have had about twice normal exposure.

Stop-Bath and Fixers

7. STOP-BATH

Water	1 litre	16 oz.
Acetic acid, glacial	15 c.c.	¼ oz.

Rinse negatives in the dish for 30 seconds or in the tank for 1 minute. Rinse papers for about 10 seconds. When rapid processing is necessary the times can be reduced by doubling the strength of the bath.

8. FIXERS

Either Amfix Ultra Rapid Fixer with Special Hardener (May & Baker, Ltd.) or a standard 'acid fixer' or 'acid hardening fixer' is recommended. Follow the directions given with the product and in Chapters IV and V.

Print Developers

9. DEVELOPERS FOR CHLORIDE PAPERS

Use either one or other of the developers recommended by the manufacturer of the paper, or a good 'universal'

developer such as Johnson Universal. Standard methods yield the best results.

10. DEVELOPERS FOR BROMIDE PAPERS

A. For normal use

Use one or other of the developers recommended by the manufacturer of the paper, or a good 'universal' developer such as Johnson Universal. Johnson Bromide developer and similar 'bromide' developers generally give a more marked bluish cast to the image than those of the 'universal' type. Amidol developers are useful as they give good colour and can be diluted for softer results. The time of development in dilute developers must be long enough to give rich blacks or quality will be lowered throughout the scale. Excessive amounts of potassium bromide in a developer give an unpleasant greenish tinge; small quantities of organic 'developer improvers' such as Johnson 142 and Kodak Anti-Fog have no such tendency and may even improve the colour slightly. The purpose of both is to minimise fog due to the development of unexposed silver grains in the emulsion.

B. For prints from negatives of excessive contrast

The following developer (Kodak D.165) gives soft contrast on bromide papers and can also be used for lantern-plates and other transparencies and for negatives.

'Elon' (metol)	6.0 gm.	42 gr.
Sodium sulphite, anhydr.	25.0 gm.	175 gr.
Sodium carbonate, anhydr.	37.0 gm.	259 gr.
Potassium bromide	1.0 gm.	7 gr.
Water to make	1 litre	16 oz.

For use, take one part of the solution and three parts of water. Develop bromide papers for 2 minutes at 65 degrees Fahrenheit (18 degrees Centigrade). The development time for P.300 plates at the same temperature is 4 to 6 minutes.

C. For prints from negatives of very low contrast

'Contrast' and 'press contrast' developers sometimes give slightly higher contrast than do normal print-developers, but their chief difference is that they work faster. A developer of 'universal' type, used at a higher concentration than usual, may be tried.

11. DEVELOPERS FOR CHLOROBROMIDE PAPERS

The standard developers recommended by the manufacturers of the paper generally give off-black colours. The colour can be changed by toning or a special developer designed to give another colour in the first place can be used. For brown tones on Kodak Bromesko, use Kodak D.166 diluted 1 to 3 (or 1 to 7 for the concentrated form as sold in bottles) and develop for 2 minutes at 65 degrees Fahrenheit (18 degrees Centigrade). For brown tones on other chlorobromide papers the author uses Johnson Chlorquinol Developer diluted to one third or one quarter of the usual strength and with the addition of small quantities of restrainer. Exposure times must be increased and full development in a highly diluted and restrained developer may take as long as 20 minutes. Both developers are conveniently purchased in liquid form.

12. INTENSIFIERS AND REDUCERS

See Chapter IV.

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